U. S. Government

RESEARCH REPORTS

February 13, 1959
Vol. 31, No. 2

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U. S. DEPARTMENT OF COMMERCE
Office of Technical Services

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U. S. Government RESEARCH REPORTS

U. S. DEPARTMENT OF COMMERCE

OFFICE OF TECHNICAL SERVICES

Vol. 31, No. 2 Pp. 81-121 February 13, 19

AGRICULTURE

Air Proving Ground Center, Eglin AFB, Fla.
STUDIES OF VEGETATION GROWTH CONTROL ON LAND RANGES AT EGLIN AIR FORCE BASE, FLORIDA, by E. G. Rodgers. Armament test rept. Mar 58, 82p. APGC TR-58-22; AD-146 918.
Order from LC mi $4.80, ph $13.80 PB 135 235

Objectives of this study were to test the efficiency of available herbicides in control of turkey oak (Quercus laevis) and other native vegetation and to find a low-growing plant species, adapted to environmental conditions on Eglin ranges, which would retard or prevent re-establishment of tall-growing plants. Six phenoxy-type herbicides, Ammate X, Amitrol, the benzoic acid materials, and dalapon were applied at different rates to turkey oak and other native vegetation on several Eglin ranges. Only the phenoxy-type herbicides provided satisfactory brush control. Monuron applied in 1955 at rates from 10 to 30 lb per acre killed turkey oak and similar brush by the second growing season after treatment. Kuron and propon (at 4 lb per acre) and the ester formulation (at 3 lb per acre retarded the growth of turkey oak for about one year. Since Pensacola bahiagrass was well adapted to conditions on Eglin ranges, it is recommended that this grass be planted on future Eglin ranges at the time of activation. To establish Pensacola bahiagrass, 15 lb of seed per acre should be planted on well chopped soil, applying 500 lb per acre of an 8-8-8 fertilizer, and spraying annually with 3 lb per acre of iso-octyl ester of 2, 4, 5-T.

ASTRONOMY

Astrophysical Observatory, Smithsonian Institution, Cambridge, Mass.
EVIDENCE ON THE NATURE OF AIRFLOW AROUND STONY METEORITES IN FLIGHT, by E. P. Henderson and D. T. Williams. Technical rept. 9 on Contract AF 18(600)1596. Apr 58, 45p. AFOSR TN-58-436; AD-158 240.
Order from LC mi $3.30, ph $7.80 PB 135 157

The flow markings on the surface of a series of stony meteorites were photographed and rationalized in the light of simple aerodynamic theory. Complete agreement between theory and experiment was demonstrated as relating to the orientation of the objects during flight, and separation of flow from bluff objects near the edges.

Harvard Coll. Observatory, Cambridge, Mass.
CLASSIFICATION OF SOLAR PROMINENCES - V - 1953, by Donald H. Menzel and F. Shirley Jones. Scientific rept. 9 on Contract AF 19(604)1394. [1958] 87p. AFCRC TN-58-406; AD-152 557.
Order from LC mi $4.80, ph $13.80 PB 135 249

A tabulation of the behavior classification of prominences observed at Sacramento Peak, Sunspot, New Mexico, for the period January 1 to November 25, 1953, and at the High Altitude Observatory, Climax, Colorado, for the period November 25 to December 31, 1953, according to the scheme devised by Menzel and Evans (1953) and revised by Menzel and Jones (1956). (See also PB 125 620, 127 971, 132 935, 132 936)

BEHAVIORAL SCIENCES

Personnel and Training

Air Force Personnel and Training Research Center, Lackland AFB, Tex.
THE DEVELOPMENT OF THE AIR FORCE AURAL CODE TEST, by Edwin A. Fleishman and Morton P. Friedman. Rept. on Observers and Other Aircrew Training. Nov 57, 49p. 11 refs. AFPTRC TN-57-131; AD-146 404.
Order from LC mi $3.00, ph $7.80 PB 135 478

Improvement of procedures for selecting airmen for radio operator training has been a persistent problem in the Air Force program. The attrition rate of students in such training was, at one time, as high as 40 percent. A continuing effort with AFPTRC to develop new procedures in this area resulted in considerable improvements. This report describes the Air Force Aural Code Tests, a product of recent research. This test, now operational in the Airman Classification Bettery, receives the major weight in selection of radio operators. The Rhythm Discrimination Test and the Army Radio Code Test, evaluated as the two most promising predictors of proficiency in radio operator training, were combined as Parts I and II respectively, of the new Air Force Aural Code Test. Part I was shown to have significant validity, high reliability, suitable difficulty, and added to the already substantial validity of the Army Radio Code Test. Revision of the Army Radio Code Test, Part II of the

new test, resulted in reduced mean scores and a more skewed distribution of scores. However, there is considerable evidence that the shorter form measures the same relevant abilities.

Air Force Personnel and Training Research Center, Lackland AFB, Tex.
SOME STANDARIZED TESTS OF AUDITORY-PERCEPTUAL ABILITIES, by Edwin A. Fleishman and Morton P. Friedman. Rept. on Observance and Other Aircrew Training. Nov 57, 41p. AFPTRC TN-57-132; AD-146 405.
Order from LC mi $3.00, ph $7.80 PB 135 479

The original purpose for developing these tests was an interest in the skill components underlying proficiency in radiotelegraphy. However, these skills may have more general utility for other skills where auditory discrimination is critical. This report serves as a preliminary manual for certain of these tests. Complete instructions and scoring keys are presented for the Copying Behind, Dot Perception, Code Distraction, and Hidden Tunes tests, and the available distribution, reliability, validity and intercorrelation data are summarized. Briefer descriptions are presented for tests of rhythm, pitch, time, intensity, timbre discrimination, and tonal memory, as well as for the Army Radio Code and Signal Corps Code Aptitude tests. Data presented should assist other research workers in making preliminary decisions regarding the usefulness of the individual tests. With increasing demands on the information-handling capacity of the human operator, it is possible that more use will be made of the auditory channel. If so, the tests described may be of use in selecting personnel for jobs in which auditory perception is critical, e. g., operators of radar systems with audio-returns of personnel engaged in certain kinds of countermeasure operations.

Human Resources Research Office, George Washington U., Washington, D. C.
EVALUATION OF THE ON-THE-JOB PROFICIENCY OF TRAINED TANK CREWMEN, by Robert A. Baker, Eugene F. MacCaslin and others. Special rept. 14 on Contract DA 44-109-qm-650. June 58, 61p.
Order from LC mi $3.90, ph $10.80 PB 135 143

This study consisted of two phases: (1) determination of the armor knowledge and operational skill of trained, experienced tank crewmen, and (2) determination of the existing degree of crew interchangeability (i.e., how well crew members can serve in other crew positions as well as their own). Knowledge and performance tests on the essential armor skills (given to 256 T/0&E tank crewmen) showed that individual proficiency levels are low; job activity records showed that time is given to training in T/0&E units. Paper-and-pencil tests on the four crew jobs (given to 715 T/0&E crewmen) showed that crew members tend to specialize rather than to be interchangeable.

Physchological Services, Inc., Los Angeles, Calif.
A CORRELATIONAL ANALYSIS OF ACHIEVEMENT IN A GENERALIZED ELECTRONIC TROUBLESHOOTING COURSE, by Neil D. Warren, William F. Dossett, and James S. Ford. Research rept. on Contract AF 41(657)44. Dec 57, 32p. AFPTRC TN-57-148; AD-146 424.
Order from LC mi $3.00, ph $6.30 PB 134 739

The present study was designed to provide information about the GETS (Generalized Electronic Troubleshooting) curriculum and trainer fundamental to its intelligent use in research investigations and as a practical selection and training instrument.

Psychology

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
TRACKING PERFORMANCE AS A FUNCTION OF EXPONENTIAL DELAY BETWEEN CONTROL AND DISPLAY, by Marvin Levine Rept. on Learning and Transfer in Reference to Training Aid Design. Oct 53, 21p. WADC TR 53- 236; AD-26450.
Order from LC mi $2.70, ph $4.80 PB 135 126

Two experiments were performed to determine the effects of exponential delay on the ability of the human operator to stay on target in a compensatory tracking task. Data were obtained from 12 subjects who were exposed to a 1-dimensional, compensatory tracking situation where exponential delay was inserted between the operator's input and the output of the system. The amount of delay ranged from 0.015 to 2.700 sec for each subject. Results indicated that time-on-target (TOT) decreased with increasing delays. This can be expressed by the equation Y=19.45-2.26X, where Y=TOT in seconds and X=delay ranging from 0.150 to 2.700 sec. For delays less than 0.150 sec, the performance decrease had a steeper negative slope.

California U., Berkeley.
AN ANALYSIS OF LIFE HISTORY INTERVIEWER'S RATINGS FOR 100 AIR FORCE CAPTAINS, by Donald G. Woodworth, Frank Barron, and Donald W. MacKinnon. Research rept. on Selecting and Classifying Air Force Personnel, Contract AF 18(600)8. Nov 57, 32p. AFPTRC TN-57-129; AD-146 401.
Order from LC mi $3.00, ph $6.30. PB 135 535

An extensive psychological assessment was carried out of a group of 100 Air Force captains in order to develop a set of procedures which would identify those officers who were most effective in their jobs. Life-history interviews were conducted with each of the captains, and a set of ratings was derived from these intensive interviews. Ten of the interview ratings were presumed to be of fundamental psychiatric significance and had been designed to represent predetermined areas of personal development and adjustment. A centroid factor analysis was made of

the intercorrelations among the 10 variables and the resultant factors were related to variables derived from the non-interview phases of the assessment program. It was concluded that personal interview ratings show promise of contributing to the overall evaluation of Air Force officer personnel.

School of Aviation Medicine, Randolph AFB, Tex. CONCEPT DISCRIMINATION IN RHESUS MONKEYS, by W. Lynn Brown and John E. Overall. Jan 58, 8p. Rept. 58-35.
Order from LC mi $1.80, ph $1.80 PB 134 368

School of Aviation Medicine, Randolph AFB, Tex. EFFECT OF WHOLE-BODY RADIATION UPON ASSOCIATION OF PERIPHERAL CUES, by W. Lynn Brown, Richard M. Carr, and John E. Overall. Mar 58, 5p. Rept. 58-47; In cooperation with U. of Texas.
Order from LC mi $1.80, ph $1.80 PB 134 364

The experiment was designed to determine whether the subjects associated peripherally placed stimuli, and whether normal and irradiated subjects differed in the extent to which such association was made. The results are interpreted as supporting the hypothesis of a shift in response thresholds to extraneous stimuli and the hypothesis of a narrowing of attention in irradiated subjects.

Teachers Coll., Columbia U., New York. ATTITUDES, EDUCATIONAL PROGRAMS, AND JOB EXPERIENCES OF AIRMEN WHO DID NOT REENLIST, by Robert L. Thorndike and Elizabeth P. Hagen. Rept. on Contract AF 18(600)1359. June 57, 101p. AFPTRC TR-57-2; AD-134 209.
Order from LC mi $5.70, ph $16.80 PB 135 533

A group of nonreenlistees were surveyed in an attempt to provide information about their atitudes toward the AF, civilian educational programs, and work experience. A sample of about 750 men from each of 7 career fields was studied. Information was obtained by interview or by questionnaire from men who had been out of the AF for about a year. Results indicated that interest in reenlisting is more frequent for men (1) in low-priority career fields, (2) not continuing their education, (3) having low aptitude indexes, (4) receiving low civilian pay and few benefits, (5) disliking their civilian job, and (6) of low socio-economic status. A large proportion of nonreenlistees continued their education during the first year after separation, some 30% in colleges and 25% in other types of institutions. About 50% of those with technician specialty indexes of 9 were in college, half of them in engineering programs. About a fourth or a fifth of the men were in civilian jobs bearing some relationship to, and based in part on, their AF experience.

BIOLOGICAL SCIENCES

Office of Naval Research, Washington, D. C. AN ANNOTATED BIBLIOGRAPHY AND CRITICAL REVIEW OF DRUGS AND PERFORMANCE. Aug 58, 84p. 190 refs. ONR rept. ACR-29; AD-163 401.
Order from OTS $2.25 PB 131 917

A selected bibliography provides the basis for this symposium review. Participants represent diverse fields of inquiry and their discussion crosses disciplines in consideration of problems associated with maintaining and enhancing human performance under normal and stressful conditions. The content of this symposium indicates the need for a systematic experimental research program directed toward the biochemical, physiological, and psychological effects of drugs on human performance.

School of Aviation Medicine, Randolph AFB, Tex. BEHAVIOR OF THE RADIATION PROTECTIVE AGENT AET IN AQUEOUS BUFFERED SOLUTIONS AND HUMAN SERUM, by Bernard Shapiro. Jan 58, 17p. Rept. 58-21.
Order from LC mi $2.40, ph $3.30 PB 134 373

Anatomy and Physiology

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio. EFFECT OF WATER IMMERSION ON HUMAN TOLERANCE TO FORWARD AND BACKWARD ACCELERATION, by Stuart Bondurant, William G. Blanchard and others. Rept. on Biophysics of Space Flight. July 58 [13]p. 8 refs. WADC Technical Rept. 58-290; AD-155 808.
Order from OTS $0.50 PB 151 315

Accepted physical principles suggest that immersion of subjects in water should consitute effective protection against some of the effects of acceleration. This premise has been evaluated in a study of the duration of tolerance of immersed subjects to forward accelerations of 6 through 14 g. Respiration was maintained by the use of skin diver's breathing equipment. With proper positioning, acceleration time tolerances were observed which were in excess of twice any previously reported.

Ohio State U. Research Foundation, Columbus. HISTORICAL SURVEY OF INHABITABLE ARTIFICIAL ATMOSPHERES, by William F. Ashe, C. Crain Wright and others. Rept. of abstracts and references for 1 Apr 57-30 June 58 on Contract AF 33(616)5103.
Sep 58, 154p. WADC Technical rept. 58-154; AD-155 901.
Order from OTS $3.00 PB 151 277

World literature on production and control of artificial atmospheres for living organisms was surveyed; literature in the fields of human biology and medicine, microbiology, botany and zoology was covered. All pertinent articles were abstracted. These abstracts; authors, title, and source of each article make up the body of this report. Abstracts were arranged under the following groups: Carbon Dioxide, Carbon Dioxide Removal Systems, Carbon Dioxide at High Partial Pressure, Electromagnetic (Including Cosmic) Radiation, Variation of "G" Forces, Heat-Cold and Temperature Regulation, Noise, Oxygen, Oxygen Generation, Oxygen at High Partial Pressure, Oxygen Instrumentation, Oxygen at Low Partial Pressure, Odor, Pressure, Pressure Low, Pressure Explosive Decompression, Sealed Cabins or Containers, Toxic Substances, Water and Moisture Control, Miscellaneous Factors. Each abstract has a five-unit code symbol for cross reference among the four major fields. No conclusions are made by the authors as to potential value of any abstract in the production of any desired atmosphere.

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
A PROBABILITY APPROACH TO CERTAIN NEUROELECTRIC PHENOMENA, by Lawrence S. Frishkopf (Thesis). Rept. on Contract DA 36-039-sc-42607. 1 Mar 56, 78p. 78 refs. Technical rept. no. 307; AD-107 077.
Order from LC mi $4.50, ph $12.30 PB 135 178

The response attitude of the first neural component (N_1) was studied as a function of click intensity. Adult cats were anesthetized by IP injection of Dial in urethane (0.75 cc/kg of body weight). An incision about 3 in. long was made along the midline of the head and extended at both ends away from the medial line. An earphone was connected to a plastic tube which was inserted in the external auditory meatus. An electrode was placed in contact with the interior surface of the bulla, and the reference electrode was attached at an exposed area at the back of the neck. A rectangular pulse, 0.1 msec in duration, was used to drive an earphone. Attenuators allowed a total voltage range at the input to the phone of 145 db (from 0 to - 145 db) in 1-db steps. Responses were photographed with a Grass 35-mm camera on continuously moving film. The behavior of N_1 suggests that the contributing neural elements might be classified as either sensitive or insensitive. A model was developed in which properties of neural units are defined. A relatively homogeneous population of neural units, characterized by rapidly fluctuating thresholds, is responsible for the initial component of growth of the intensity function. The results of 2 experiments were compared with the predictions of the model. The amplitude variability of N_1 was studied as a function of stimulus intensity. The effect was investigated of a continuous noise background on the amplitude of the N_1 response to a click. A relatively homogeneous population of neural units, characterized by rapidly fluctuating thresholds, is responsible for the initial component of growth of the intensity function; over the remaining interval of the intensity function, a single-population hypothesis will not account for the data within the framework of the model.

School of Aviation Medicine, Randolph AFB, Tex.
ALTITUDE EXPOSURE AND INTRA-AORTIC INFUSION OF NORADRENALIN IN THE DOG, by Gordon Vawter and Howard H. Wayne. Feb 58, 9p. Rept. 58-30.
Order from LC mi $1.80, ph $1.80 PB 134 371

Noradrenalin sufficient to elevate mean femoral arterial pressure to 180 mm. Hg was continuously infused into the ascending aorta of 8 dogs for 15 minutes at ground level, during ascent to altitude, and for 55 minutes at 34,000 feet. Seven experiments with infusion of saline under similar conditions provided control data.

School of Aviation Medicine, Randolph AFB, Tex.
CUMULATIVE AUDITORY FATIGUE, by James F. Jerger. Mar 58, 11p. Rept. no. R 58-46; In cooperation with Audiology Lab., Northwestern U.
Order from LC mi $2.40, ph $3.30 PB 134 365

The cumulative effects of repeated fatigue-producing stimuli on threshold recovery time were explored as a function of the intensity of the fatiguing stimulus in 26 normal ears. Results demonstrated a cumulative effect on recovery time for the threshold at 4500 cps when the SPL of the 3000-cps fatiguing tone equaled or exceeded 95 db.

School of Aviation Medicine, Randolph AFB, Tex.
EFFECTS OF REPEATED EXPERIMENTAL BLOOD LOSS ON THE HEMATOLOGY OF THE MACACA MULATTA MONKEY, by George M. Krise and Niel Wald. Sep 57, 7p. Rept. 57-149.
Order from LC mi $1.80, ph $1.80 PB 134 353

Biochemistry

School of Aviation Medicine, Randolph AFB, Tex.
EVALUATION OF DIRECT PHOTOMETRIC DENSITY MEASUREMENTS IN SERUM AGAR COLUMNS, by William G. Glenn and I. Marable. Nov 57, 6p. AFSAM rept. 58-10.
Order from LC mi $1.80, ph $1.80 PB 134 354

A statistical evaluation of optical density measurements made on a single precipitin zone in normal human serum albumin diffusing into pooled rabbit anti-V sera shows the relationship between (1) zonal optical density and relative antibody concentration and (2) zonal optical density and time. Measurements were made with the Serum Agar Measuring Integrator (SAMI).

School of Aviation Medicine, Randolph AFB, Tex.
PHYSIOLOGIC CHLORIDE LEVELS IN HUMAN

WHOLE SALIVA ELICITED BY RUBBER BAND STIMULATION, by Ira L. Shannon. Aug 57, 7p. Rept. 57-142.
Order from LC mi $1.80, ph $1.80 PB 134 375

School of Aviation Medicine, Randolph AFB, Tex.
TISSUE CARBON DIOXIDE CONCENTRATIONS IN HYPERCAPNIC RATS, by Alan Thompson and E. B. Brown, Jr. Dec 57, 6p. Rept. 58-11.
Order from LC mi $1.80, ph $1.80 PB 134 374

Tissue carbon dioxide concentrations were measured in rats following exposure of the intact animals to 10 or 30 percent $C0_2$ in oxygen for various time intervals. In these experiments the average normal $C0_2$ concentrations in skeletal muscle, heart, and brain were 13.2, 18.6, and 15.1 mM./kg. of wet tissue, respectively. After about 5 minutes on 30 percent $C0_2$ or 10 minutes on 10 percent $C0_2$ the skeletal muscle concentration consistently exceeded the normal range. In all three tissues $C0_2$ concentrations were approximately doubled after 35 minutes on 30 percent $C0_2$.

Pathology

School of Aviation Medicine, Randolph AFB, Tex.
CARDIOVASCULAR EVALUATION OF WEST POINT CADETS: A FOUR-YEAR STUDY, by Lawrence J. Milch, William F. Taylor and others. Mar 58, 7p. Rept. 58-29.
Order from LC mi $1.80, ph $1.80 PB 134 372

School of Aviation Medicine, Randolph AFB, Tex.
EVALUATION OF METHODS FOR HYPERSENSITIZING MICE, by William E. Harris. Feb 58, 11p. Rept. 58-41.
Order from LC mi $2.40, ph $3.30 PB 134 367

School of Aviation Medicine, Randolph AFB, Tex.
NORMAL AND ABNORMAL HUMAN-ANTIHUMAN PRECIPITIN REACTIONS IN AGAR COLUMNS, by William G. Glenn, Gerard F. Lanchantin and others. Jan 58, 11p. AFSAM rept. 58-32.
Order from LC mi $1.80, ph $1.80 PB 134 369

Quantitation of serum agar columns by the direct photometric method gives graphic profiles of human-antihuman rabbit precipitin reactions. By standardization of the antisera through selection, it was possible to distinguish between 47 normal and 28 abnormal human serum samples by their agar diffusion patterns.

CHEMISTRY

Inorganic Chemistry

American Potash and Chemical Corp. (Nevada), Henderson.
CHEMICAL MANGANESE DIOXIDE, by Martin A. Prieto, Gordon S. Douglas, and Roger W. Hoffmann. Final rept. 15 Oct 55-15 Apr 56 on Contract DA 36-039-sc-70143. 125p. 30 refs. AD-120 145.
Order from LC mi $6.30, ph $19.80 PB 135 378

The object of this study is to conduct laboratory investigations leading to the pilot plant stage of development of a feasible and efficient chemical process for the production from low grade domestic manganese ores to a military battery grade manganese dioxide meeting or exceeding the general characteristics and performance requirements of the Signal Corps Specification SCL-3117-D, 18 March 52, entitled: "Manganese Dioxide, Synthetic".

Metal Hydrides, Inc., Beverly, Mass.
THE PREPARATION OF TRANSISTOR GRADE SILICON FROM SILANE OR ANALOGOUS COMPOUNDS, by Henry C. Kelly, Thomas J. Flynn and others. Final rept. 1 Sep 56-31 Aug 57 on Contract AF 19(604)1928. 74p. 24 refs. AFCRC TR-57-198; AD-133 701.
Order from OTS $2.00 PB 131 875

The preparation, purification and thermal decomposition of silane has been investigated for the purpose of preparing transistor grade silicon. Yields of 94 to 100% silane are obtained by the reduction of silicon tetrachloride with various hydrides. A process has been developed for the continuous preparation, fractionation, and decomposition of silane to produce 2-15 gram quantities of high purity silicon.

Organic Chemistry

Harvard U., Cambridge, Mass.
ORGANOSILOXANE POLYMERS CONTAINING POLAR GROUPS IN THE SIDE CHAINS, by Sanders D. Rosenberg and Eugene G. Rochow. Rept. on Synthesis and Evaluation of New Polymers, Contract AF 33(616)479. July 54, 31p. WADC TR 54-102; AD-43-063.
Order from LC mi $3.00, ph $6.30 PB 135 450

Research was conducted to study the possible synthesis of N- and B-containing polymerizable Si monomers of $\underline{p}$-$R_2MC_6HSi(CH_3)X_2$, where M is either N or B and X is a hydrolyzable group. Attempts to prepare a suitable B-containing Si monomer were unsuccessful. Symmetrical organoboron compounds were prepared by the reaction of a

Grignard reagent with BCl_3 or trimethyl borate. The preparations of di -n-butyl- and di -n-propyl-bromoboron resulted from the reaction of the respective symmetrical compounds with Br. Trimethylallyslilane and trichlorosilane were condensed under the activation of benzoyl peroxide to form trimethyl-3-trichlorosilypropylsilane. From the IR spectra of the prepared organoboron compounds, a tentative assignment of the C-B absorption frequency was made at 1370 to 1390 cm^{-1} or 1320 to 1340 cm^{-1}.

Morton Chemical Co., Woodstock, Ill.
ORGANIC POLYMERS CONTAINING ALUMINUM AND TITANIUM, by Robert L. Frank, Andrew A. Baldoni and Thomas R. Patterson, Jr. Rept. for Jan 56-Dec 57, on Study of Synthesis and Properties of Ferrocenes and Organic Polymers Containing Aluminum and Titanium, Contract AF 18(600)1599. Jan 58, 12p. AFOSR TR-58-18; AD-148 137.
Order from OTS $0.50 PB 131 753

The formation and properties of two types of chelated aluminum polymers were studied. Monochelated polymers prepared from diisopropoxy or dichloro aluminum monochelates displayed limited hydrolytic and thermal stability. Polymers of trichelated aluminum were prepared and found to be more resistant to hydrolysis. They varied from low-melting, readily organic-soluble thermoplastics to intractable solids stable at 360°C. Linear polymers were prepared from dichelated titanium diisopropoxides and organic diols. The most stable of these was the product from an 8-quinolinol chelate and 2, 2-bis (4-hydroxyphenyl) propane ("Bisphenol-A"), which was inert toward boiling water and when heated to ca 400°C. The properties of the chelated aluminum and titanium monomers are given.

Princeton U., N. J.
THE KINETICS AND MECHANISM OF ETHYLENE OXIDE DECOMPOSITION AT HIGH TEMPERATURES, by L. Crocco, I. Glassman, and I. E. Smith. Rept. on Contract AF 18(600)1527. 10 Apr 58, 21p. AEL rept. no. 416; AFOSR TN-58-273; AD-154 174.
Order from OTS $0.75 PB 131 932

As part of an undertaking to study combustion processes in rocket motors, a new type flow reactor was developed for the determination of reaction rates at high temperatures. This new flow reactor deals conveniently with systems that fall within the reaction time range of 1 to 100 milliseconds. Thus it permits study of reactions too fast for the classical kinetic techniques and too slow for shock tube experiments. In order to properly evaluate this flow reactor a complete study was made of the ethylene oxide decomposition reaction up to temperatures approaching the adiabatic decomposition point.

Stanford Research Inst., Calif.
EFFECTS OF HIGH-ENERGY, HIGH-INTENSITY ELECTROMAGNETIC RADIATION ON ORGANIC LIQUIDS, by E. M. Kinderman. Rept. for May 56-Apr 57 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)3738. 5 July 57, 56p. 57 refs. WADC Technical rept. 57-465; AD-157 459.
Order from OTS $1.50 PB 131 936

A series of organic esters, hydrocarbons, and miscellaneous compounds were subjected to radiation. A quantitative measurement of the amounts and kinds of radiation products produced was made. From the observed products and their amounts, some inferences were made as to the stability of these materials and the influence that their structure had on their stability. Comparison of the radiolytic with mass spectrographic data shows some correlation between the modes of molecular disintegration induced in the two cases. Both electron and gamma radiation was used. The available data do not permit definite statements of equivalence between electron and gamma effects. (See also PB 131 362)

Physical Chemistry

Amherst Coll., Mass.
THE ADSORPTION OF n-HEPTANE ON SOLIDS AT LOW PRESSURES, by R. A. Beebe, D. M. Young, and H. Bienes. Technical rept. 2, 1 Sep 51-1 Aug 52, on Contract N8onr-660(02). Sep 52, 14p. AD-6689.
Order from LC mi $2.40, ph $3.30 PB 135 427

Adsorption isotherms have been measured for n-heptane on graphite, ferric oxide and on reduced silver powder at low pressures. The rate of attainment of adsorption equilbrium has been studied in detail; the results suggest that the discontinuities in the isotherms for the above systems claimed by earlier workers were in fact due to inadequate time being allowed for the establishment of equilibrium.

Fairchild Engine Div., Deer Park, N. Y.
THEORETICAL CALCULATIONS IN GASEOUS DETONATION, by C. L. Eisen, R. A. Gross, and T. J. Rivlin. Rept. on Contract AF 49(638)15. Mar 58, 104p. AFOSR TN-58-326; AD-154 230.
Order from LC mi $5.70, ph $16.80 PB 135 266

This study treats one dimensional steady flow combustion in the Mach number range of 0 to 10. Original data are presented for a wide variety of hydrocarbon fuels burning with air. Particular attention is given to the classical Chapman-Jouguet point. The results include the effect of dissociation and ionization. The program is applicable to any hydrogen, carbon, oxygen and nitrogen system. The theory, equations and method of solution are presented. The accuracy of the computation is discussed.

Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena.
SPECTROSCOPIC STUDIES OF REVERSE-JET FLAME STABILIZATION, by A. E. Fuhs. Technical rept. 24 on Contract DA 04-495-ORD-446. June 58, 25p. 11 refs. AD-137 093.
Order from LC mi $2.70, ph $4.80 PB 135 209

Conditions in the critical zone have a strong influence on the stability of a flame which is held stationary by a small jet directed counter to the main stream. Using the spectral intensity ratio method, the local equivalence ratio in the critical zone was measured. The results suggest that there is one stability curve (blow-off velocity as a function of the equivalence ratio in the critical zone) regardless of jet composition. The equivalence ratio in a reverse-jet stabilized flame was determined locally as a function of duct radius. Jet composition affects the observed equivalence ration radially as far as the duct walls although only weakly beyond about one third of the duct radius.

Northrop Aircraft, Inc., Hawthorne, Calif.
STABILITY OF TANTALUM CARBIDE IN HYDROGEN AT ELEVATED TEMPERATURES IN THE PROGRAM ON THE STABILITY OF REFRACTORY ELEMENTS AND COMPOUNDS IN A HYDROGEN ATMOSPHERE AT ELEVATED TEMPERATURES, by L. A. Ohlinger. Aug 48, declassified 8 Nov 57, 21p. NEPA 696-NOR-48; AD 145 609.
Order from LC mi $2.70, ph $4.80 PB 135 680

From the analyses as well as visual observation it is apparent that tantalum carbide shows no tendency to decompose when exposed to hydrogen at temperatures as high as 2400°C. However, at temperatures above 2400°C., there is some evidence of slight decomposition of the TaC in a hydrogen atmosphere, although this effect is not evident in a neutral atmosphere. In addition, at temperatures above 2400°C., TaC does have a tendency to shrink and become more dense, particularly during long exposures. Therefore, if this material is to be used in a service in which it must remain dimensionally stable as well as inert, it should be limited in use to temperatures below 2400°C. Otherwise, if dimensional instability and slight decomposition are not significant, its service temperature may be something in excess of 3200°C., although the exact amount is not known.

Research Chemicals, Inc., Burbank, Calif.
SELECTION AND EVALUATION OF RARE OR UNUSUAL METALS FOR APPLICATION TO ADVANCED WEAPONS SYSTEMS. PT. I. A LITERATURE SURVEY, by Bernard Love. Rept. for June-Sep 57 on Metallic Materials, Contract AF 33(616)5293. June 58, 174p. 752 refs. WADC Technical rept. 57-666, pt. 1; AD-155 685.
Order from OTS $3.00 PB 151 311

A survey has been made of the unclassified literature relating to the rare earth elements, hafnium, rhodium, and ruthenium. The best available data has been compiled for the abundance and distribution of the contents, the methods of recovery from ores and purification, the reduction to metal, and the physical, chemical, and mechanical properties of the elements and their important compounds.

Research Inst., Temple U., Philadelphia, Pa.
HIGH TEMPERATURE PROJECT, by A. V. Grosse Progress rept. 2, 15 Oct 49-1 May 50, on Contract N9onr-873(00). 11 May 50, 53p. AD-135 200.
Order from LC mi $3.60, ph $9.30 PB 135 477

An experimental study of the combustion of the metals Mg, Ca, Al, Ti, Zr, and Na in oxygen, at atmospheric and higher pressures.

Stanford Research Inst., Menlo Park, Calif.
MECHANISM OF FLAME INHIBITION, by Willis A. Rosser, Jr. and Henry Wise. Final rept. on Phase 1, Contract DA 44-009-eng-2863. 15 May 57, 31p. 12 refs. AD-134 445.
Order from OTS $1.00 PB 131 797

In order to elucidate the mechanism of flame inhibtion by chemical agents, the burning velocities of premixed CH_4-air and of NH_3-O_2-N_2 mixtures were measured in the presence of halogen-containing substances. Additional experiments were carried out to study the effect of halogen-containing substances on diffusion flames supported by a liquid fuel. An analysis of the experimental results suggests a mechanism involving a sequence of chemical reactions characterized by an inhibition chain in which the effective inhibitors are the halogen atoms and halogen acids.

EARTH SCIENCES

Control Systems Lab., U. of Illinois, Urbana.
WIND WAVES OF THE WATER, by Bruce L. Hicks and Clive G. Whittenbury. Rept. on Contract DA 36-039-sc-56695. Dec 56, 151p. Rept. no. R-83; AD-130 443.
Order from LC mi $7.50, ph $24.30 PB 133 827

This paper reviews the origin and nature of wind waves on deep water. In order that the subject be treated properly it is necessary to include an extended discussion of the air boundary layer over water. This emphasis upon the aerodynamics of wind waves distinguishes the paper from earlier treatments of the subject.

Mapping and Charting Research Lab., Ohio State U. Research Foundation, Columbus.
THE BALANCING OF THE GRAVITY FIELD, by R. A. Hirvonen. Rept. on Contract AF 19(604)1963 July 57, 14p. Technical paper no. 716-3; AFCRC

TN-57-242; AD-133 820.
Order from LC mi $2.40, ph $3.30 PB 135 490

An application to a free-air anomaly field is presented. A series of spherical harmonics representing the anomalies must not display any terms of first degree nor first order terms of second degree to balance the gravity field. These terms are made to disappear by correcting the assumed anomalies. The mean anomalies of 30 by 30° squares on the northern hemisphere are used to compute the corrections that are added to the hypothetical anomalies. Corresponding corrections to the elevation N of the geoid are shown. The greatest corrections on the northern hemisphere are +6 m near Hawaii and -4 m near Bermuda.

Pennsylvania State U., University Park.
ANALYSIS OF THE INDUSTRIAL GEOGRAPHY OF THE PORT OF GENOA, ITALY, by Allan L. Rodgers. Annual rept., 1956, on Contract Nonr [656(11)]. Jan 57, 9p. AD-119 204.
Order from LC mi $1.80, ph $1.80 PB 134 356

The present study is concerned with two basic problems: (1) the role of various location factors in the development of industry in Genoa and (2) the relations of the industries of Genoa with the hinterland of the port. It is hoped that the present investigation will shed some light on the overall problem of industrial development in ports especially with respect to the effects of commodity flows through a port on industrial development.

Climatology and Meteorology

Institute of Geophysics, U. of Calif., Los Angeles.
UPPER ATMOSPHERE RESEARCH, by J. Kaplan and H. Korff Kallmann. Final rept. on Contract AF 19(604)111. 30 June 57, 261p. 533 refs. AFCRC TR-57-213; AD-133 688.
Order from LC mi $11.10, ph $42.10 PB 135 628

Various means of investigating the physical state of the upper atmosphere of the earth are discussed. They are classified according to the sources of information, e.g., rocket flights, meteor observations, sound propagation, etc. Each method is described briefly, and typical results concerning temperature, pressure, density, composition, and winds, etc. are given. A distinction is made between the physical quantities which can be measured directly and those which can only be deduced from observations and theories. Tables, graphs, and literature references are included.

Massachusetts Inst. of Tech., Cambridge.
EXTENDED-RANGE FORECASTING BY A STATISTICAL PROCEDURE, by Elizabeth A. Kelley. Scientific rept. 5 on Statistical Forecasting Project Contract AF 19(604)1566. Mar 58, 57p. 12 refs. AFCRC TN 58-278; AD-152 526.
Order from LC mi $3.60, ph $9.30 PB 134 402

Methods utilizing orthogonal functions are available for reducing the number of original predictors in statistical prediction equations. Two of these methods utilize Tsychebysheff orthogonal polynomials, ("Z's") and Empirical Orthogonal Functions ("Q's"). These two methods are used in combination to develop a statistical prediction equation for surface 5-day-mean temperature anomalies for five North American stations for the winter months of December, January, and February.

ENGINEERING

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A STUDY OF THE AUTOMATIC CONTROL OF A CONTINUOUS DISTILLATION COLUMN, by Edwin Goodell Park, Jr. and Robert Arthur Vince. Master's thesis. Aug 56, 58p. GAO-56-5; AD-105 431.
Order from LC mi $3.60, ph $9.30 PB 135 269

The application of automatic control to chemical processing and operation has previously been done largely by a trial and error procedure. The purpose of this procedure was to determine modes of control and the suitable constants of these modes which gave the most stable response.

Aeronautical Engineering

Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge.
THE EFFECTS OF STRUCTURAL ELASTICITY ON AIRCRAFT CONTROL SYSTEMS, by Vincent W. Howard. Final rept. on Contract AF 18(600)1346. June 56, 210p. WADC Technical rept. 56-166; AD-108 298.
Order from LC mi $9.30, ph $31.80 PB 135 457

A method of analyzing the effects of structural control systems is presented. This method is based essentially on including appropriate normal coupled modes of the structure as additional degrees of freedom in the airframe equations of motion and performing the standard aircraft-autopilot stability studies. The IBM 650, the Whirlwind Digital Computer and the Instrumentation Laboratory High Speed Electronic Analogue Computer, all at the Massachusetts Institute of Technology, along with the graphical aids were used in these studies. These studies show that the aircraft control system stability margins may be severely reduced unless adequate care is used in locating feedback motion sensing instruments in the airframe or appropriate changes are made in the autopilots.

Air Force Flight Center, Edwards AFB, Calif.
A COMPARATIVE EVALUATION OF THREE TECHNIQUES FOR MEASUREMENT OF LEVEL FLIGHT ACCELERATIONS, by John J. Mahoney and Donald A. Bennett. [27 Dec 56] 33p. AFFTC TN-54-2; AD-116 046.
Order from LC mi $3.00, ph $6.30 PB 134 966

Flight tests were conducted at Edwards Air Force Base, California, to evaluate the comparative practicability of measuring longitudinal aircraft accelerations by means of three techniques. These techniques involve: (1) A sensitive longitudinal accelerometer; (2) a rate of climb indicator connected to the total pressure source; and (3) an airspeed indicator and clock set in a photo panel. The latter method, which is a currently standard flight test technique, provides a basis for comparison. Results indicate that the accelerometer measuring technique is similar in accuracy to the airspeed indicator clock technique. Such factors as inefficient use of flight test time and expensive, non-standard equipment, however, appear to exclude the accelerometer as an optimum measuring technique. For convenience and economy in the measurement of level accelerations, a rate of climb instrument connected to the pitot tube offers the most promise on the basis of limited data. If future experimentation with the rate of climb instrument technique corroborates the initial appraisal, an indicator should be developed with higher range. Level acceleration measuring techniques should be reviewed periodically in order to insure that the technique proposed herein remains optimum in the light of improvements in airplane performance and instrumentation.

Odin Associates, State College, Pa.
PERFORMANCE ESTIMATION OF THE COOLANT-FUEL SYSTEM, by L. Greiner, J. Rabinowicz, and A. Zuckerman. Final summary rept. on Contract AF 18 (600)1501. Dec 57, 37p. 13 refs. OA TR-100-1; AFOSR TR-58-43; AD-154 150.
Order from LC mi $3.00, ph$6.30 PB 135 415

This report summarizes a preliminary investigation of a novel method for preventing overheating of the external structure of a rocket powered aircraft or missile that is traveling at hypersonic speeds within the atmosphere. This method contemplates using the rocket fuel for cooling the structure. In addition to maintaining the structure at manageable temperatures, it also results in a significant augmentation of the thrust of the rocket engine because the propellant energy is enhanced by the absorbed (aerodynamic) heat. It is found that by judicious selection of fuels heat absorption of 1200 to 4000 BTU/lb can be achieved with temperature rise from 77°F to 1500°F, with corresponding augmented specific impulse of 300 to 400 sec. A preliminary evaluation of the flight performance of this system is carried out. A method for determining the flight envelope for a missile configuration is presented. Cruise range calculations indicate that ranges of a few thousand miles are feasible. It is thus concluded that based on the promising preliminary results the coolant-fuel system merits more detailed studies.

Electrical and Electronic Engineering

Antenna Lab., Ohio State U. Research Foundation, Columbus.
DIFFRACTION BY RIBS OF LARGE GROUND RADOMES. Interim engineering rept., Nov 56-Jan 57, on Contract AF 30(602)1620. 1 Feb 57, 14p. 22 refs. Rept. 722-1; RADC TN-57-95; AD-114 386.
Order from LC mi $2.70, ph $4.80 PB 135 360

The purpose of this investigation is to gain a better understanding of the diffraction of electromagnetic waves by the ribs of large ground radomes and to establish principles for optimizing rib design.

Armour Research Foundation, Chicago, Ill.
ELECTRONIC COMPONENT PARTS RESEARCH FOR 500°C OPERATION, by Morton E. Goldberg, Harlan G. Hamre, and Richard D. Noble. Rept. for 1 Apr 56-31 Aug 57 on Improved Electronic Components, Contract AF 33(616)3549. July 58 [91]p. 10 refs. WADC Technical rept. 57-362. pt. 2; AD-155 785.
Order from OTS $2.25 PB 151 320

An experimental study has been made of the dielectric properties of ceramic materials and the fabrication of these materials into a form and substance suitable for capacitor dielectrics and wire insulation. A large number of ceramic bodies, both commercially available and laboratory prepared, were evaluated at 500°C for dielectric constant, dissipation factor, resistivity dielectric strength, and aging effects. A slurry containing Al_2O_3 with mono-aluminum phosphate and additions of Nalcoag has shown the most promise both for capacitors and wire. Coatings as thin as 0.001 inch have been applied to 0.005 inch diameter silver wire. Slightly heavier coatings have been applied to 24-gauge nickel wire. The properties of the coating are such that the wire can be wound on a one-half mandrel prior to curing. Similarly, 0.001-inch aluminum foil has been coated and formed into capacitors of both the stacked and rolled tubular varieties. Properties of the slurry are such that they become noticeably more brittle after short exposure to room conditions. By utilizing an overcoating of polyvinyl chloride-acetate copolymer to coated wire and foil, the ceramic is sealed from dehydration and protected against abrasion.

Communication and Navigation Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
EVALUATION OF THE REVISED INTERFERENCE BLANKER MX-1077(XA)/U, by Raymond R. Holberber and Herbert M. Bartman. Rept. on Suppression of Precipitation Static. Feb 53, declassified 3 June 55, 41p. WADC Technical rept. 53-54; AD-22 973.
Order from LC mi $3.30, ph $7.80 PB 135 403

Compliance and environmental tests upon Interference Blanker MX-1077(XA)/U are described. The blanker, with improvements, is visualized as a supplementary equipment to be used between the antenna and the input circuits of existing airborne radio receivers. In theory, it blanks out a portion of a received carrier upon which noise signals of impulse nature are superimposed. In effect, the blanker disconnects the antenna from the receiver for a certain period of time (determined by the width or duration of the blanking pulse) during which the noise is present upon the antenna. Laboratory test techniques and results are described.

Engineering Research Inst., U. of Michigan, Ann Arbor.
DEFINITIONS OF d' AND η AS PSYCHOPHYSICAL MEASURES, by W. P. Tanner, Jr. and T. G. Birdsall. Rept. on Contract AF 19(604)2277. Feb 58, 28p. 15 refs. Technical rept. 80; Rept. 2659-2-T; AFCRC TR-57-57; AD-146 758.
Order from LC mi $2.70, ph $4.80 PB 134 399

Since studies employing d' and η are based on the theory of signal detectability, the theory is reviewed in sufficient detail for the purposes of definition. The efficiency, η, is defined as the ratio of the energy required by an ideal receiver to the energy required by a receiver under study when the performance of the two is the same. The measure d' is that value of $(2E/N_o)^{1/2}$ necessary for the ideal receiver to match the performance of the receiver under study, where E is the energy of the signal, and N_o is the noise power per unit bandwidth. The measure is extended to include the recognizability of two signals. Every set of signals is described by an Euclidean space in which distances are the square roots of the energy of the difference signal, $(E_\Delta)^{1/2}$. The unit of measure is the square root of one-half of the noise power per unit bandwidth $(N_o/2)^{1/2}$.

Erie Resistor Corp., Pa.
INVESTIGATION OF TECHNIQUES AND MATERIALS TO DETERMINE THE BEST APPROACH TO SEMIAUTOMATIC PRODUCTION OF ELECTRONIC SUBASSEMBLIES USING RESISTORS AND CAPACITORS OF PIN CONFIGURATION. Final Development Rept. for 31 May 51-15 Oct 56 on Contract NObs-5237(1733). 1v.
Order from LC mi $4.80, ph $13.80 PB 136 673

To permit fabrication of the plug-in assembly, it was necessary to develop several unique processing concepts. Among these developments were the following. The method of wiring pattern fabrication: The conductive adhesive application, electroplate, and abrasive removal of excess plate are all accomplished automatically on a continuous, constant speed conveyor. Variation of the conductive pattern is easily accomplished by changing a removable plate in the die prior to molding the base block. The component cap attachments: A complete line of metal fittings, capable of filling all contact requirements of the plug-in assembly, has been developed from a basic split-cap contact. Design of the fittings was coordinated with design of the base block in such a manner that the contacts are completely interchangeable with all components in the assembly. The component subassembly fabrication machinery: The operation of this equipment is completely automatic after the component and metal fitting hoppers have been filled. Pot soldering: The unique feature of this final contact process is the fact that the contacts require no pre-fluxing and the soldering operation can be accomplished without slowing the conveyor line. Automatic potting equipment: The actual resin applying equipment is an application of a recent commercial development, but the mold material, racks, and hold-down plate assemblies are items peculiar to this application. The various processes serving to make up the over-all assembly line are tied together by a series of interconnecting conveyors which keep material handling to a minimum. Machinery for each process step is designed as a unit module in such a manner that the production volume of an individual plug-in circuit can be increased by incorporating additional similar units. In addition, the production-line flexibility is increased by the capability of rearranging individual assembly equipments. A suitable semi-automatic assembly procedure has been developed to permit mass production of electronic subassemblies containing up to twenty pin configuration resistors and capacitors and one vacuum tube. The plug-in assembly is a reasonably versatile type for certain applications, but does not lend itself to power supply construction, etc., because of the difficulty in obtaining the necessary circuit components in pin form. The flexibility of the assembly process is such that the same basic procedure can be used for the fabrication of at least 80 individual circuits. The individual process equipments, developed as integral units, permit increased production by the simple addition of similar units. The assembly process is such that all of the individual processes can be made completely automatic if production volume warrants the cost of automatic equipment. However, the break-even point for the production of 1,000 units per hour permits automation of 17 of the 29 individual process steps. The assembly process can be adapted to at least 11 and probably 26 circuits presently used in military electronic equipments.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
STUDY PROGRAM FOR INVESTIGATION TO AID IN REDUCTION AND PREVENTION OF UHF INTERFERENCE, by Floyd P. Holder, Howard L. McKinley and others. Technical rept. no. 4 on Phase 4, Contract AF 30(602)673. 1 Oct 56, 187p. 17 refs. RADC TR-57-2; AD-114 206.
Order from LC mi $8.40, ph $28.80 PB 135 248

Three methods of detecting double-sideband zero-carrier signals are described. Two methods derive the missing carrier from information in the sidebands but use different arrangements for

demodulation. The first 2 methods show more promise for practical application. The most satisfactory approach to a zero-carrier generator is a combination of balanced modulators and passive filters. Three methods of accurately recovering single-sideband zero-carrier signals and correcting for Doppler shift were investigated. One method uses a constant-level-modulation signal, subsequently amplitude-modulated with data relative to the carrier frequency. The other methods use data derived from second-harmonic distortion in the modulating wave. The carrier-recovery feature was verified experimentally, and the Doppler-correction aspect appears valid. A proposed time-compression-multiplex system should permit about 4400 interference-free voice messages to share the 225- to 400-mc region. Based on the single-sideband modulation of the total input signal by its own AM component, a means was devised for recovering a desired FM signal in the presence of a stronger, interfering FM signal. The desired signal is the lower-sideband output of the modulator. Polyphase filters and polyphase and synchronous detectors considered as filters proved inferior to certain passive types. Crystal filters with desirable characteristics are available for center frequencies at least as high as 13.0 mc.

Ohmart Corp., Cincinnati, Ohio.
STUDY AND DEVELOPMENT OF NUCLEAR BATTERIES, by Philip E. Ohmart. Rept. on Improved Electronic Components, Contract AF 33(616)172. Dec 54, 124p. WADC TR 55-35; AD-84 555.
Order from LC mi $6.30, ph $19.80 PB 135 203

During the period covered by this contract the properties of a number of electrode materials were investigated with the aim of increasing the open circuit voltage and efficiency of cells and reducing the temperature coefficient. As a result of this work with electrodes it has been possible to build single cells with open circuit voltage as high as 3.27 volts. A number of different types of nuclear batteries were built and tested with various electrode pairs. These included Models BE, AE, C, RE, V, and W batteries. All of these were considered as experimental with the exception of Model RE which was submitted to rather complete tests. These tests showed that by using 10 millicuries of strontium-90 batteries can be produced with open circuit voltages of 1.0 volts and short circuit currents of 4×10^{-9} ampers without encountering a high rejection rate. Temperature coefficient measurements showed that, in general, the open circuit voltage increases and the short circuit current decreases with a rise in temperature. By operating into load resistors of the proper value it is thought that these two temperature coefficients can be made to compensate for each other.

Philco Corp., Philadelphia, Pa.
AUDIO FILTER, by P. Z. Grayum. Final engineering rept. 15 Jan-14 Oct 56, on Contract AF 30(602)1457. 5 Dec 56, 29p. H-2080-F; RADC TR-57-29; AD-114 278.
Order from LC mi $2.70, ph $4.80 PB 135 512

The design of an active, low frequency, band-pass filter is described. The synthesis technique was the use of RC elements with transistor negative impedance converters to obtain complex poles. Very steep skirt selectivity and 20 db of transmission gain was achieved, but the variation of filter properties with temperature limits this particular filter to use in an environment such as might be encountered normally in a laboratory. It is felt that this limitation is not fundamental and could be substantially alleviated by the use of different transistor types.

Radiation Research Corp., West Palm Beach, Fla.
NUCLEAR BATTERIES, by John H. Coleman and Jerome Goodman. Progress rept. no. 16 (Final), 15 July 55-15 July 56, on Contract DA 36-039-sc-70117, Continuation of Contract DA 36-039-sc-64479. Aug 56, 31p. AD-112 969.
Order from LC mi $3.00, ph $6.30 PB 135 277

In Task A, the conductivity under high energy irradiation was studied during this contract year for diamond, sapphire, polystyrene, inhibited polystyrene, and polyester. The 'decreasing conductivity effect' was not always observed. A new strontium battery using a laminated dielectric was designed to increase life. The laminated structure is applied to a new krypton battery designed in Task B. In Task B, the construction of radioactive batteries using gaseous isotopes was proved feasible. Both krypton 85 and tritium batteries were completed. The absortion capacity of metals for tritium gas was re-examined for producing high current beta sources in a small volume Infrared absorption studies of the thin polystyrene dielectric films made by the gas discharge method indicated the presence of impurities, particularly combined oxygen, in the films. Characteristics of a titrium battery using both a vacuum and a solid dielectric were examined. In Task C, the design and cost of a carbon 14 battery were studied.

Raytheon Mfg. Co., Newton, Mass.
INVESTIGATION OF EMISSIVE MATERIALS FOR ELECTRON TUBES, by Charles J. Bardsley and Frederick T. Hill. Scientific rept. no. 8, 31 Dec 57-31 Mar 58, on Contract AF 19(604)1822. 102p. AFCRC TN-58-137; AD-146 898.
Order from LC mi $5.70, ph $16.80 PB 135 382

The effect of varying 3 exhaust-processing factors (pressure, time, and temperature) during electronic tube manufacture was investigated. The quality of the diodes as evidenced by the levels of emission and the variations in the work factors generally diminished with decreasing total heating time, increasing pressure at the preliminary low-vacuum heating step, and low-temperature heating at

exhaust in combination with a low-vacuum heating step. A repeated determination of the amount of sublimation from 330 alloy, melt 9855 showed satisfactory reproducibility.

Raytheon Mfg. Co., Waltham, Mass.
MAGNETRON PERFORMANCE AND RELIABILITY IN EQUIPMENT, by A. F. Hastie. Final engineering rept. Vol. 1, 13 June 55 - Oct 56, on Contract AF 30(635)2864. Nov 56, 115p. RADC TR-57-54; AD-114 343.
Order from LC mi $6.00, ph $18.30 PB 135 184

An investigation was made of the field reliability and performance of magnetrons RK6410/QK338, RK6517/QK358, and RK6518/QK254. The study included visits by magnetron engineers to radar installations of the Air Defense Command. Results indicate that most field problems are caused by insufficient information by field personnel concerning handling, installing, and operating the magnetrons. Direct liaison between the field environment and tube manufacture is needed. Refinements for improving compatibility of equipment and magnetron will result from the cooperation efforts of manufacturers. Many hardships imposed on manufacturers result from parallel magnetron and equipment development and by rigid delivery schedules. Close coordination between the Military Systems Project Engineer and the tube manufacturer is needed. A few specially trained engineers to investigate magnetron problems and monitor new applications as they appear in the field can prevent a build up of problems.

Rome Air Development Center, Griffiss AFB, N. Y.
GUIDE TO USAF RADAR TOWERS, by Dana A. Benson. May 58, 61p. RADC TN-58-136; AD-148 734.
Order from LC mi $3.90, ph $10.80 PB 135 314

The data contained in this report is applicable to radar towers in general use and those under design and development. The data is a compilation of the general and special features of each tower; no design of tower structures is included. Data on towers which are still in the development stage is subject to changes, but the data on towers in or beyond production will generally remain fixed, or vary only slightly as improvements are added over the life span of a tower.

Stanford Electronics Labs. Stanford U., Calif.
A CONVERGENT HOLLOW-BEAM ELECTRON GUN FOR MICROWAVE TUBES, by C. Susskind. Rept. on Contract DA 36-039-sc-63189. 29 June 56, 54p. 19 refs. Technical rept. no. 450-1; AD-107 537; In cooperation with Microwave Lab., Stanford U.
Order from LC mi $3.60, ph $9.30 PB 134 986

The theory of hollow beams is summarized and applied to a particular design of current interest: a convergent beam that requires no structure inside the beam, except in the region of the electron gun. The focusing scheme is a variant of 'Brillouin flow. The effect of departing from a prescribed radial distribution of current density (to the extent of permitting the use of a uniform current density at the cathode, and no 'transition' section) is investigated and found to be sufficiently small for the proposed design. The results obtained in a special beam tester (described in the Appendix) show the design to have enough advantages over solid beams to justify its employment in certain applications despite the somewhat increased complexity in design and manufacture.

Wilmotte, Raymond M., Inc., Miami, Fla.
INSTANTANEOUS CROSS-CORRELATOR. Letter rept. no. 11 on Contract AF 30(602)1494. 21 Sep 56, 7 p. Rept. 1029; RADC TN-56-416; AD-97 930.
Order from LC mi $1.80, ph $1.80 PB 135 476

The Sylvania zirconium arc was eliminated as a source of light, since the light produced by an arc has the effect of making the point of light move around the electrode. Not only was the arc very noisy, but its motion was disturbing to the measurements. Replacement will be made with a General Electric Type 5A/G 16 1/2/1 which operates at 20 v with a current of 5 amp. To reduce noise in the system, a photocell and a video amplifier will be substituted for the photomultiplier. The ultrasonic delay line consists of a piece of quartz 3-in. long having a cross section of 0.25- x 0.05 -inch. The beam of light passes through the length of the quartz. The quartz is cemented on a $BaTiO_3$ transducer with epoxy resin. At the other end of the quartz line, is a piece of catalin about 1 sq cm also cemented with epoxy resin. The catalin had a considerable effect in reducing the SWR and in damping the quartz. The measured SWR was approximately 2.5. Testing, however, revealed that an appreciable amount of the energy was being dissipated in the catalin instead of in the transducer. To correct this deficiency an absorber was designed to absorb all the energy from the end of the quartz delay line and make the SWR practically negligible. Measurements of the cross-correlation function for various positions of the delay line indicated that the maximum value of the function is 0.25 which is very close to the theoretical value.

Ordnance, Missiles, and Satellite Vehicles

Armour Research Foundation, Chicago, Ill.
INVESTIGATION OF ELECTROMAGNETIC LAUNCHER FOR HIGH-SPEED PROJECTILES, by J. L. Radnik and A. Bak. Final rept. on Contract AF18(603)56. May 58, 74p. AFOSR TR-58-84; AD-158 393.
Order from LC mi $4.50, ph $12.30 PB 135 363

The design and performance characteristics of a parallel rail electromagnetic accelerator were studied to determine the feasibility of the linear

motor accelerator as a research tool capable of accelerating small particles to velocities of 25,000 feet per second and above. The program consisted of a study of the basic electromechanical relationships, a study of suitable energy sources, and the design, construction, and evaluation of an experimental accelerator system. More than one hundred test projectiles were fired with a ten foot, two turn experimental accelerator energized by a 12,500 joule capacitor bank-transformer arrangement. A maximum muzzle velocity of 1990 feet per second was attained with a 5.8 gram steel-aluminum projectile at a conversion efficiency of 8.5 percent. The best results were obtained with projectiles having a hard metallic sleeve which partially confined the molten metal at the contact surfaces. From this work it was concluded that the most serious problem in achieving hypervelocities with the parallel rail electromagnetic accelerator is the contact problem. The use of multiple turns and a projectile design which minimizes the arcing losses appear to be the most promising approaches. Inductive and capacitive storage were concluded to be the most suitable energy sources for a parallel rail hypervelocity accelerator installation.

Land Locomotion Research Lab., Detroit Arsenal, Center Line, Mich.
INVESTIGATION OF GUN ANCHORING SPADES UNDER THE ACTION OF IMPACT LOADS, by L. Karadiath and M. G. Bekker: Oct 57, 39p. OTAC rept. 19.
Order from LC mi $3.00, ph $6.30 PB 134 351

An investigation of conventional and novel gun spade types indicates that the "spaced link" spade as proposed in this report offers a prospect for the radical improvement of the anchoring power of the spade. Since new guns are expected to be more powerful, yet lighter because of airportability requirements, a general method for gun spade evaluation has been proposed. This method is quite accurate in frictional soils and lends itself to limited use in cohesive soils.

MACHINERY, FABRICATION, AND ACCESSORY EQUIPMENT

Ohio State U. Research Foundation, Columbus.
COATINGS FOR THE PROTECTION OF CERAMIC BODIES, by F. H. McRitchie and N. N. Ault. Monthly summary rept. 13 on Proj. 321. July 48, 34p. NEPA 689-OSU-13 AD-146 568.
Order from LC mi $3.00, ph $6.30 PB 135 684

Reactions between coating materials were studied by pressing powdered materials into pellets and firing them in contact with beryllia disks. Coatings were prepared by wet spraying milled mixtures of the coating materials on beryllia. Firing was done in a porcelain muffle tube with controlled atmospheres of hydrogen or helium. A chromium-alumina coating was developed. A prolonged test at 2500°F (1370°C) revealed excessive weight loss. Silica was found to react violently with beryllia to give a bloated structure. Titanium-zirconia coatings had excellent structure, but penetrated into the beryllia. Wetting of beryllia by titanium was produced by firing a titanium pellet on a beryllia disk in a hellium atmosphere. The titanium reduced the beryllia at the contact surface, and a third phase formed near the interface in the titanium. This reaction led to the development of a chromium-alumina coating with small titanium additions, which gave the most promising results.

MATERIALS

Emerson and Cuming, Inc., Canton, Mass.
SCIENTIFIC REPORT NO. 1, 1 June-1 SEPTEMBER 1957, by J. W. Lefforge and J. W. Copley. Rept. on Controlled Dielectric Constant Material Development, Contract AF 19(604)2448. 4 Sep 57, 9p. AFCRC TN-57-765; AD-133 708.
Order from OTS $0.50 PB 131 835

Controlled dielectric constant (K) materials covering the range K=1.5 to 3.0 have been made which are physically stable to 600°C by loading a matrix of borosilicate glass bubbles with titanium dioxide Bonding is obtained below 275°C by a heat-polymerizing silicone resin. Higher temperature bonding is by means of the borosilicate glass. Dielectric constants may be increased beyond 3 by increasing the TiO_2 loading, but density will also be increased to about 0.7. Exploratory experiments indicate the K may be increased to about 5 by using loadings of silver flake rather than TiO_2. Dielectric constants obtained thereby are not reproducible and losses are higher than with TiO_2.

Forest Products Lab., Madison, Wis.
COMPARISON OF TEST METHODS FOR EVALUATING ADHESIVES FOR BONDING METAL FACINGS TO METAL HONEYCOMB CORES, by H. W. Eickner and Fred Werren. Rept. on Structural Adhesives, Contract AF 33(038)51-4326E. July 54, 44p. WADC TR-54-138; AD-40 744.
Order from LC mi $3.60, ph $9.30 PB 135 746

Various shear, tension and peel tests were compared on matched specimens from sandwich panels of Al facings bonded to Al honeycomb core with adhesive processes. Flatwise shear and flexural tests gave similar shear values; failures generally occured in the core. The tension tests gave good indication of relative strengths of the bonds when stresses were normal to the glue line. The peel tests included direct and drum peel under static and impact loading. The tests conducted evaluated different properties. All of the tests should be used for a complete evaluation of adhesives.

Institute of Rubber Research, U. of Akron, Ohio.
DEGRADATION STUDIES ON CONDENSATION POLYMERS, by Marvin A. Deisz and Masao Ohta. Final rept. 15 Mar 55-13 Mar 57, on Contract DA-36-039-sc-64641. Apr 57, 87p.
Order from OTS $2.25 PB 131 795

The object was to conduct degradation studies on condensation polymers such as the polysiloxanes and polyurethane polyesters, in order to throw light on the nature of the breakdown of polycondensate linkages in these polymers.

Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
AN EVALUATION OF FUNGICIDAL TREATMENTS IN COTTON CARGO PARACHUTE WEBBINGS STORED AT COLLEGE, ALASKA, by Emma F. Little. Rept. for May 53-Apr 58 on Finishes and Materials Preservation. Aug 58 [58]p. 1 ref. WADC Technical rept. 56-384, pt. 2; AD-155 857.
Order from OTS $1.50 PB 151 252

Fungicidal formulations with water repellents and without water repellents were applied to four types of cotton cargo parachute webbings made to Specification MIL-W-5665A. Three of the formulations contained copper 8-quinolinolate and the fourth contained dihydroxy-dichloro-diphenyl methane. All formulations of copper 8-quinolinolate, except Formulation B, evaluated in this research were satisfactory fungicidal treatments in cotton cargo parachute webbings, Specification MIL-W-5665C, providing the minimum metallic copper content as copper 8-quinolinolate was 0.14% by dry weight of the treated material. On this basis, the minimum amount of copper 8-quinolinolate required to give adequate fungus resistance was 0.83% by dry weight of the treated material. The formulation of dihydroxy-dichloro-diphenyl methane was equally acceptable for USAF use providing the minimum fungicide content was 0.9% by dry weight of the treated material. The formulation of dihydroxy-dichloro-diphenyl methane was equally acceptable for USAF use providing the minimum fungicide content was 0.9% by dry weight of the treated material. Water repellents added to the basic fungicidal formulations slightly improved the overall fungus resistance of the treated webbings. The phthalocyanin dye used for Type XV webbing was not compatible with any of the fungicidal formulations. Untreated webbing containing this dye was badly discolored and tacky. Mineral dye was compatible with all materials.

Naval Research Lab., Washington, D. C.
HIGH-TEMPERATURE LUBRICANTS FROM AROMATIC ACIDS AND FLUOROALCOHOLS, by C. M. Murphy, J. G. O'Rear and others. 5 Nov 58 [12]p. 16 refs. NRL rept. 5223.
Order from OTS $0.50 PB 151 157

Aircraft gas-turbine engines soon to become operational will require lubricants which are considerably more resistant to pyrolysis and oxidation than are the alkyl diesters covered by Specification MIL-L-7808. Previous research at NRL revealed that fluoralcohol esters of aliphatic acids had improved oxidation stability but were relatively volatile. To obtain esters with decreased volatility and increased stability, studies were extended to fluoroesters derived from aromatic acids, including the potentially available acids 2-phenylsuccinic, 2-phenyglutaric, diphenyl-2, 2'-dicarboxylic or diphenic, and diphenyl ether 4, 4'-dicarboxylic. The diphenate is preferred because of its oxidation stability at 527°F, its thermal stability at 600°F, and its lower volatility as compared with fluoroalcohol esters of aliphatic acids. These gains are made at some expense of viscometric properties and freezing point. The results of this investigation open the way to more stable and less volatile fluoroesters which offer promising candidates for high-temperature jet-engine lubricants.

Ceramics and Refractories

New Jersey Ceramic Research Station, Rutgers U., New Brunswick.
PROGRESS REPORT NO. 6, 1 MARCH-1 JUNE 1954, by E. J. Smoke; A. V. Illyn, and B. R. Eichbaum. Rept. on Contract DA 36-039-sc-42577. July 54, 72p.
Order from LC mi $4.50, ph $12.30 PB 135 261

The high thermal conductivity of silicon carbide, previously evaluated, was incorporated into a high magnesia body. High silicon carbide content bodies fluxed with Alsilox were also fabricated. The study of the effect of minor additions to the QC6F1 type body, in an attempt to improve its electrical properties, is continued. In order to further improve the electrical properties of bodies E-16, F-8, and F-6 substitutions of lead bisilicate were made wholly or partially for the lead borate content. The effect of additions of up to 12% alumina in the E-16 type body (20% No. 4 ball clay, 60% wollastonite, 10% barium carbonate and 10% lead borate) was studied. The standardization of the procedure and testing equipment used in the study of this work is discussed. An investigation made on bodies containing a large amount of a crystalline phase which expands on heating (in this case spodumene and pyrophyllite) indicates that such bodies expand but shrink below the green size when fired to maturity.

Northrop Aircraft, Inc., Hawthorne, Calif.
STABILITY OF ZIRCONIUM NITRIDE IN HYDROGEN AT ELEVATED TEMPERATURES IN THE PROGRAM ON THE STABILITY OF REFRACTORY ELEMENTS AND COMPOUNDS IN A HYDROGEN

ATMOSPHERE AT ELEVATED TEMPERATURES, by L. A. Ohlinger. Sep 48, declassified 25 Nov 57, 21p. NRR-170; NEPA 786-NOR-61; AD-146 566.
Order from LC mi $2.70, ph $4.80 PB 135 667

In the presence of carbon, zirconium nitride appears to undergo a marked change at about 2500°C., which renders its use in hydrogen above this temperature undesirable. Although the materials will not decompose or disintegrate in hydrogen at temperatures up to 2900°C., the indications in our tests are that the material should not be used in hydrogen in the presence of carbon at temperatures above 1500°C. for complete stability, above 1800°C. for partial stability and low weight loss or about 2500°C. under any conditions, even where large weight loss and dimensional increases are not significant. Under these conditions, one can expect the formation of some carbide compound and a gradual change in the character of the material. From the results of the tests, one might theorize that this material in hydrogen in a carbon-free atmosphere might be reasonably stable at much higher temperatures, say to 2000°-2500°C., and sufficiently strong to withstand temperatures as high as 2700 - 2800°C. under the proper conditions; but this postulation must be accepted as pure conjecture and not as authoritative.

MATHEMATICS

Chicago U., Ill.
SEMINAR IN TOPOLOGY. PART I. RESEARCH ON ALGEBRAIC MECHANISM OF FIBER SPACES, by Saunders MacLane. Rept. on Contract AF 18(600)1383 and NSF grant G-3462. 1957, 54p. AFOSR TN-57-769; AD-136 759.
Order from LC mi $3.60, ph $9.30 PB 134 433

Contents:
A relation between homotopy groups and cohomology groups by J. F. Adams
The suspension of a loop space, by W. D. Barcus, and J. P. Meyer
Higher Hopf invariants, by M. G. Barratt
The construction and classification of semi-simplicial bundles, by M. G. Barratt, V. K. A. M. Gugenheim, and J. C. Moore
Atomic homology structures, by F. W. Bauer
Homology of prolonged functors (symmetric products, a.o.), by Albrecht Dold
Regular mappings and dimension, by Eldon Dyer
Comological dimension of groups, by Samuel Eilenberg

Chicago U., Ill.
STABILIZATION OF COMPUTER CIRCUITS, ed. by E. Hochfeld. Rept. on Contract AF 33(616)2797. Nov 57, 34p. WADC Technical rept. 57-425; AD-155 740.
Order from OTS $1.00 PB 151 255

Continuous computers are frequently used to solve a set of differential equations or to generate known functions as solutions to a set of differential equations. In general, the output errors in a continuous computer are time-dependent and will tend to grow. This places a limitation on the running time of most analog problems. It is herein shown how the functions in question can be generated as solutions to a set of differential equations different from the classical set. The new set of differential equations included corrective factors which are functions of the errors, and though the circuit which represents their solution is more intricate than the classical circuit and involves more components, its solutions will have error bounds that are not time-dependent. This basic theorem is proved herein. As specific applications of the general theory, it is herein shown how one can generate the trigonometric functions sine and cosine and a set of three orthonormal vectors wherein the errors in the solutions will have bounds which are time-invariant. The above is supported by experimental evidence, the results of which are included in this report.

Institute of Statistics, North Carolina State Coll., Raleigh.
STUDY OF INDEPENDENCE AND DEPENDENCE IN MULTIVARIATE NORMAL ANALYSIS, by Rolf Bargmann. Rept. on Contract AF 18(600)83, Partially supported by the Thurstone Research Fund of Science Research Associates. Dec 57, 111p. Mimeograph series 186; AFOSR TN 58-242; AD-154 144.
Order from LC mi $6.00, ph $18.30 PB 135 374

Contents:
Tests of independence and associated confidence bounds
Tests of quasi-independence and associated confidence bounds
Generalized distributions and the problem of Confidence statements

Reducible patterns of dependence
Degrees of Dependence (factor analysis)
Numerical illustrations

Midwest Research Inst., Kansas City, Mo.
A GENERALIZATION OF A THEOREM OF LAGUERRE, by Udell L. Luke. Rept. on Contract AF 49(638)66. 15 June 58, 21p. 8 refs. AFOSR TN-58-487; AD-158 295.
Order from LC mi $2.70, ph $4.80 PB 135 409

Additional results are given concerning function $E(z) = {}_2F_1(a, b; c; -1/z)$ and a rational approximation to it, $E_n(z) - \phi_n(z)/f_n(z)$. The differential equation satisfied by $f_n(z)$ is constructed and matched with a known differential equation for $f_n(z)$. This analysis leads to a system of 2 linear differential equations involving $f_n(z)$ and 2 other polynomials, Θ_n and H_n. A proof is given that if = 0 (appears in the definition of $\phi_n(z)$ in the γ - procedure), Θ_n and H_n are independent of $f_n(z)$. This fact is used to prove that $f_n(z)$ and g_n satisfy the same differential equation where $g_n = (\phi_n - Ef_n)z - \omega(z+1)\omega - \eta$. Various representations of $\phi_n - Ef_n$ are constructed.

Princeton U., N J
ON THE COMPLEX PROJECTIVE SPACES, by F. Hirzebruch and K Kodaira. Technical rept. 6 on Research in Problems Connected with Differentiable and Complex Analytic Structures, Contracts DA 36-034-ORD-2164 and AF 18 (600)231. [Dec 56] 22p. 10 refs. AD-116 212.
Order from LC mi $2.70, ph $4.80 PB 135 397

The following theorem is proved: Let X be an n-dimensional compact Kahler manifold which is C^∞ -differentiable homeomorphic to the complex projective space $P_n(C)$ with its usal differentiable structure. When the dimension n of X is odd, X is complex-analytically homeomorphic to $P_n(C)$. Let g be the generator of the second cohomology group $H^2(X, Z)$ ($\cong Z$) whose sign is chosen so that g is represented as the fundamental class of a Kähler metric on X. When n is even, X is complex-analytically homeomorphic to $P_n(C)$ if the first Chern class c_1 of X is not equal to -(n+1)g. An immediate consequence of a theorem by Kodaira (Ann. Math. 60:28-48, 1954) states that a compact Kähler manifold X which is homeomorphic to $P_n(C)$ is an algebraic manifold. Without loss of generality, X can be assumed to be an algebraic manifold. The proof of the given theorem is based on the general Riemann-Roch theorem (from which it can be deduced that for odd n, the first Chern class c_1 of X is (n+1)g), and a theorem on vanishing of cohomology groups. Nine related lemmas and theorems are proven to obtain the given basic theorem.

Purdue Research Foundation, Lafayette, Ind.
ON SQUARE ROOTS AND LOGARITHMS OF SELF-ADJOINT OPERATORS, by C. R. Putnam. Technical note 4 on Commutators on a Hilbert Space, Contract AF 18(603)139. May 58, 3p. AFOSR TN-58-275; AD-154 177.
Order from LC mi $1.80, ph $1.80 PB 135 373

The following theorems are proved: (1) if B is a non-negative self-adjoint operator, and if A is any solution of $A^2=B$ (A is not assumed to be self-adjoint or even normal) satisfying $\mathrm{Re}(A) \geqq 0$, then necessarily A is the unique non-negative self-adjoint square root of B. (2) If A is a ligarithm of a positive self-adjoint operator $B = \int \lambda \, dE$ so that $e^A = B$ (> 0) and if $A \leqq 2 \log 2$ then necessarily A is the self-adjoint operator $A = \int \log \lambda \, dE$ ($\log \lambda$ real). All operators are bounded and linear on a Hilbert space.

North Carolina State Coll., Raleigh.
AN EVALUATION OF DYE DISPLACEMENT TECHNIQUE FOR VELOCITY DISTRIBUTION MEASUREMENTS IN LAMINAR FLOW, by James K. Ferrell. Rept. on Wind Tunnel Studies, Contract AF 33(616)31. July 54, 82p. 25 refs. WADC Technical rept. 54-372; AD-65 528.
Order from LC mi$4.80, ph$13.80 PB 135 577

An evaluation has been made of a new technique using dye displacement for measuring the velocity distribution of liquids flowing in laminar flow inside circular tubes The experimental method consists of spectrophotometric measurement of the rate of displacement of a dye solution in a glass tube by a clear solution entering the tube from above. This displacement rate is related to the velocity at points within the tube. This technique has the advantage over existing methods for measuring velocity distribution in that all measuring elements are outside the tube wall and thus the fluid is not disturbed at the point of measurement. The suggestion is made that the technique may be applicable to the measurement of the diffusion coefficient for liquids. It appears that the technique may also be applicable to the measurement of molecular and eddy diffusion for a fluid flowing in a turbulent flow and for velocity measurements within the laminar sub-layer of a fluid in turbulent flow.

Aerodynamics and Pneumatics

Aeroelastic and Structures Research Lab., Mass. Inst of Tech., Cambridge.
INDICIAL DOWNWASH AND ITS STRUCTURAL EFFECT ON THE HORIZONTAL TAIL, by Norman P. Hobbs. Rept. on Atomic Weapon Effects on Aircraft Systems, Contract AF 33(616)3259. Aug 56, 244p. 19 refs. WADC Technical rept. 56-164; AD-97 325.
Order from LC mi$11.10, ph$37.80 PB 135 456

The growth of lift on an airfoil entering a moving gust field at an arbitrary rate (not necessarily at the forward speed of the airfoil) is considered for incompressible, non-viscous flow. This lift is compared with results of subsonic shock tube tests of a double wedge airfoil. The indicial downwash, or transient downwash resulting from an instantaneous change in angle of attack of a two-dimensional airfoil as in the Wagner problem, is determined numerically. This downwash is determined primarily for observation points in the plane ot the wake at various distances behind the airfoil. Effects of vertical displacement of the observation point from the plane of the wake, finite span, and viscosity are also considered. In addition, the downwash for observation points in the plane of the wake is numerically determined for the case of an airfoil entering a gust field at an arbitrary rate. The theoretical downwash is compared with shock tube data obtained by observing the direction of the wake from a wire placed downstream from a sensing airfoil. Finally, the effect of the indicial downwash on the horizontal tail is considered.

Brown U. Div. of Engineering, Providence, R. I.
INVESTIGATION OF THE UNSTEADY FLOW PATTERN IN THE WAKE OF CYLINDERS AND SPHERES USING A HOT-WIRE PROBE, by C. Cometta. Rept. on Contract AF 18(600)664. Oct 57, 36p. 14 refs Technical rept. WT-21; AFOSR TN-57-760; AD-136 749.
Order from LC mi$3.00, ph$6 30 PB 133 338

Results obtained by hot wire anemometer surveys of wakes behind circular cylinders at subsonic speeds and high Reynonds numbers are presented. The investigation was concerned in particular with the behavior of the Strouhal number at and near the critical Reynolds number. The irregular range above a Reynolds number of 300, in which turbulent velocity fluctuations accompany the periodic formation of vortices, and which was believed not to extend beyond Re=10,000, is shown to exist up to Re=1,000,000. Above a Reynolds number of Re=200,000 and a cylinder diameter to channel width ratio of 0.23 there appeared two simultaneous vortex streets. On the outside of the ordinary vortex street there were observed two layers containing oscillations of lower frequency. The dependence of the Strouhal number of Reynolds number behind three-dimensional bodies, such as spheres, was determined. Periodic formation of vortices could not be observed above a Reynolds number of 40,000. For spheres of diameter greater than about 2 cm there appeared to be a critical Reynolds number of 7400 at which the Strouhal number changed rapidly from one value to a very much different value. This phenomenon could not be satisfactorily explained. It is believed that there exists only one type of vortex formation for spheres, namely a relatively stable arrangement of vortex loops.

Chicago U., Ill.
DETERMINING AIR REACTIONS ON MOVING VEHICLES. PT. I. METHODS OF FREE BALLISTICS, By M. Z. Krzywoblocki. Rept. on Contract AF 33(616)2797. June 57, 132p. 628 refs. WADC Technical rept. 56-51, pt. 1; AD-161 003.
Order from OTS $2.75 PB 151 319

The earliest attempts to describe analytically the air reactions on a moving vehicle grew out of the problem of determining the path of a projectile through air

after leaving a gun or rifle. In these efforts (motivated primarily by military considerations), the initial position (gun emplacement) and initial velocity (muzzle velocity) together with the mass of the projectile were given and it was desired to solve Newton's equation (F=ma) for the trajectory. Since the projectile moves through air, the air exerts a force on the projectile during its entire travel. The analytical representation of this force was required in order to solve the basic equation for the path of the body. Many of the methods originating in this early phase have been extended for use in present-day procedures and much of the nomenclature (revealing the basic thinking) remains unchanged. For these reasons it has seemed logical to begin with this body of knowledge in examining the problem of determining the air reactions on moving vehicles. Thus, Part I, "Methods of Free Ballistics," of WADC Technical Report 56-51 contains a comprehensive review of this early work. Since the ultimate goal of free ballistics in this period was the trajectory resulting from the integration of Newton's equations of motion, the representation of the air reaction was influenced heavily by the integration methods available. For this reason the pertinent integration procedures are discussed. The various forms of air reactions used (primarily resistance or drag) are listed and their proper place in the overall scheme is noted. General conclusions are drawn as to the extent to which the methods of free ballistics progressed toward the complete solution of the problem of determining air reactions on a moving vehicle. Part I concludes with an exhaustive bibliography.

Engineering Research Inst., U. of Michigan, Ann Arbor.
INTERACTION OF PLANE AND CYLINDRICAL SOUND WAVES WITH A STATIONARY SHOCK WAVE, by W. R. Johnson (Thesis) and O. Laporte. Rept. on Contract Nonr-1224(18). June 57, 144p. 21 refs. Rept. 2539-8-T; AD-146 197.
Order from LC mi$7.20, ph$22.80 PB 134 290

This investigation treats the problem of the interaction of plane and cylindrical sound waves with a stationary shock wave theoretically. The linearized Euler differential equations and the corresponding linearized shock conditions serve as the fundamental laws for this study.

Guggenheim Aeronautical Lab., Calif. Inst. of Tech., Pasadena.
EXPERIMENTAL STUDY OF THE EFFECT OF MASS INJECTION AT THE STAGNATION POINT OF A BLUNT BODY, by Howard M. McMahon. Rept. on Hypersonic Research Project, Contract DA 04-495-ORD-19. May 58, 145p. Memo. 42.
Order from LC mi$7.20, ph$22.80 PB 135 141

An experimental study of the effect of the injection of nitrogen and helium coolant gases at the stagnation point of a blunt body was carried out in the GALCIT Hypersonic Wind Tunnel at a Mach number of 5.8. The gases were injected straight out of the stagnation point and also tangential to the body surface. The model was also fitted with flow separation spikes. The injection of the coolant gas resulted in a marked reduction in the model equilibrium temperature, and this cooling effect persisted over the entire length of the model. For the same mass flow, helium was a better coolant than nitrogen.

Hiller Helicopters, Palo Alto, Calif.
ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF THE FEASIBILITY OF PRODUCING STATIC LIFT BY VORTEX MOTION, by R. M. Lockwood. Technical summary rept. on Contract AF 49(638)171. 14 Jan 58, 57p. 144 refs. Rept. no. 178; AFOSR TR-58-16; AD-148 115.
Order from LC mi$3.60, ph$9.30. PB 135 188

A broad preliminary investigation has been conducted to determine if it is feasible to create static life in air with small-scale cyclonic vortex motion. A survey of the literature and a variety of experiments with simple equipment were conducted. On the basis of this work a revised description of the fundamentals of cyclonic vortex motion is made, which also suggests some reasons why this motion occurs. The conclusions are as follows: (1) Cyclonic vortices have been formed between paired suction drains with counterrotating circular flow around them. (2) It should be possible to derive some lift from an arrangement like the preceding one, but magnitudes have not yet been determined. (3) It does not appear to be feasible to induce a cyclonic vortex in air over a single drain which is unenclosed (i.e., completely open to the atmosphere). (4) There is a possibility that half-ring vortices may be created by means of intermittent jets. (5) The passage of the ends of a half-ring vortex across a surface might induce a pressure differential on that surface.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
SONIC LIMIT SINGULARITIES. PART I. GENERAL THEORY, by G. S. S. Ludford and S. H. Schot. Rept. on Contracts AF 49(638)154 and DA 36-034-ORD-1486. May 58, 23p. Technical rept. BN-134; AFOSR TN-58-398; AD-154 307.
Order from LC mi$2.70, ph$4.80 PB 135 365

A new classification of limit singularities which may occur on the sonic line is given. The properties of the corresponding flows are investigated, and it is shown that every sonic limit singularity must lie on a sonic or a supersonic limit line.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
SONIC LIMIT SINGULARITIES. PART II. EXAMPLES, by G. S. S. Ludford and S. H. Schot. Rept. on Contracts AF 49(638)154 and DA 36-034-ORD-1486. May 58, 32p. Technical note BN-135; AFOSR TN-58-419; AD-158 222.
Order from LC mi$3.00, ph$6.30 PB 135 366

Previously developed theory is extended to an investigation of the case of general n≠0, the separation constant, to show that the corresponding class of flows

has certain well defined geometrical features. For n less than a certain value n_0, a typical sonic limit line flow in the physical plane represents a compressible analog of the incompressible flow about a corner with a certain corner angle and must be envisaged as taking place on a quadruply sheeted surface. The sheets are joined at a supersonic limit line which has the shape of a portion of a hypocycloid ($n>1$) or epicycloid ($n<1$). For $n<1$, portions of the same sheet overlap in the large. The shape of the sonic limit line is discussed when solutions corresponding to different n are superposed. In this case the supersonic limit line can be eliminated and isolated sonic limit line is obtained.

Statics, Kinematics, and Kinetics

[Aeroelastic and Structures Research Lab.]
Mass. Inst. of Tech., Cambridge.
THE RESPONSE OF A FLAT SIMPLY-SUPPORTED PANEL TO THE ACTION OF A PRESSURE WAVE, by Gabriel Isakson and Claude W. Brenner. Rept. on Contract N5ori-078(33). 24 Oct 52. 65p. AD-8076.
Order from LC mi$3.90, ph$10.80 PB 135 319

The response of a flat uniform panel, simply supported along two parallel edges and unsupported along the other two, to the passage over it of a pressure wave of typical form is analyzed. Two cases are considered -- one in which the wave impinges on the panel perpendicularly, and the other in which the wave moves parallel to the panel. The problem is set up in terms of non-dimensional parameters, and a Lagrangian type of analysis is carried out. A program is prepared for solution by means of an electronic analogue computer of the differential-analyzer type. The results of such computations carried out on the Reeves Electronic Analogue Computer (RESC) are presented for practical ranges of the significant parameters A comparison is made of results for the two cases, and it is found that it is not feasible to introduce the simplification of replacing the parallel-moving wave by an equivalent perpendicular wave.

Reed Research, Inc., Washington, D. C.
DISCUSSION ON THE NONLINEAR OSCILLATIONS OF VISCO-ELASTIC PLATES, by Johann Martinek. Rept. on Contract AF 18(600)1832. Dec 55. 11p. Rept. no. 1054B-TN-2; AFOSR TN-56-47; AD-80 559.
Order from LC mi$2.40, ph$3.30 PB 134 410

Discussion of paper no. 55-APM-15, On The Non-Linear Oscillations of Visco-Elastic Plates, by C. A. Enrigen.

Some of the reasons why a material as defined by Maxwell, as compared to a Mayer-Voigt material, is more realistic are presented For the case of small oscillations of visco-elastic plates, the differential equation of motion can then be solved by classical methods if a Maxwell material is used.

METALLURGY

Battelle Memorial Inst., Columbus, Ohio.
A STUDY OF BETA EMBRITTLEMENT IN HIGH-STRENGTH TITANIUM ALLOYS, by Andrew J. Griest Arthur P. Young and others. Rept. for 1 Mar 57-28 Feb 58 on Metallic Materials, Contract AF 33(616) 5007. Aug 58, 114p. 17 refs. WADC Technical rept. 58-161; AD-155 835.
Order from OTS $2.25 PB 151 278

Studies were conducted to determine the importance of beta grain size as a contributing factor to the loss of ductility that occurs when titanium alloys are heat treated at temperatures above the beta transus. In a second phase of the research a heat-treatment program was carried out in an effort to develop procedures for restoring ductility in beta-embrittled material. To supplement these studies, a microscopic study of deformation in pertinent microstructures was conducted. The primary cause of beta embrittlement is the large grain size which is obtained so rapidly in many alpha-beta titanium alloys when heated into the beta field. Grain-boundary alpha and acicular intragranular alpha in the microstructure are not detrimental if the beta grain size is fine. The structures resulting from beta treatments are quite stable and can not be significantly altered in a beneficial way by heat treatment alone. Certain alloys (such as Ti-16V-2.5Al) show a relatively low rate of beta grain growth. Development of alloys exhibiting this property appears to offer the most promising means of avoiding or minimizing beta-embrittlement effects.

Case Inst. of Tech., Cleveland, Ohio.
THE EMBRITTLEMENT OF ALLOY STEEL AT HIGH STRENGTH LEVELS, by L. J. Klingler, W. J. Barnett and others. Rept. on Supporting Research on Aircraft Structural Materials, Contract AF 33(038) 22371. July 53, 89p. 40refs. WADC TR-53-205; AD-22 974.
Order from LC mi$4.80, ph$13.80 PB 135 418

The embrittlement phenomenon which may occur on tempering quenched steels to high strength levels is a precipitation or aging phenomenon. A structure composed of 100 percent bainite is not subject to the embrittling reaction. It is proposed that the embrittlement arises from localized precipitation of cementite in the prior austenite grain boundaries which precedes the general precipitation.

Illinois U., Urbana.
AGING IN Au-Ni ALLOYS, by John Sivertsen and Charles Wert. Rept. on Contract AF 18(603)22. Apr 58, 31p. AFOSR TN-58-368; AD-154 274.
Order from LC mi$3.00, ph$6.30 PB 135 369

Measurements have been made of changes in physical properties of quenched alloys of 70% Au-30% Ni annealed at low temperatures. Changes in the electrical resistance, volume, and Young's modulus were observed.

Structural Metallurgy and Corrosion

Naval Research Lab., Washington, D. C.
NORMALIZATION PROCEDURES FOR NRL DROP-WEIGHT TEST, by P. P. Puzak and A. J. Babecki. 3 Nov 58 [22]p. 8 refs. NRL rept. 5220.
Order from OTS $0.75 PB 151 114

The development of standard test conditions in the NRL drop-weight test and the effectiveness of those conditions are discussed. It is shown that the 0.3-in. anvil stop permits wide latitude in nominal test procedures without materially affecting the nil-ductility transition (NDT) results obtained in the standard test. Test conditions established for 3-1/2 x 14 x 1 in. specimens (0.3-in. anvil stop, and a 12-in. span) have been validated by numerous correlations with service failure steels. As a result, these test conditions are considered the "reference-standard" test conditions. Strain conditions developed on the tensile surface of the standard test specimen must be reasonably duplicated in nonstandard specimens before comparable NDT temperatures are obtained. Test data for 90 steels are presented, and procedures for a determination of surface strain in the drop-weight test are explained in terms of the weld crack-opening developed in specimens tested at temperatures approximately 100°F above the NDT temperature. These procedures, or any other valid measure of surface strains, can be utilized to establish the test conditions necessary to achieve a normalization of variables involving odd-size specimens. Normalized test conditions employed for specimens which vary from 1/2 to 7-5/8 in. in thickness are shown to result in NDT determinations which duplicate within experimental and engineering requirements the NDT of a given steel determined in the reference-standard test.

Northwestern U., Evanston, Ill.
STRESS INDUCED STRAIN AGING, by J. O. Brittain and S. E. Bronisz (Los Alamos Scientific Lab.) Rept. on Contract AF 18(600)1598. 6 June 58, 21p. 17 refs. AFOSR TN-58-369; AD-154 275.
Order from LC mi$2.70, ph$4.80 PB 135 370

Experiments have been carried out to study the effect of an applied stress on the strain aging phenomena in steel. It was found that stress-induced strain aging reaction proceeds rapidly in the temperature range or 0° to 60°C. The variation of stress-induces strain aging with plastic strain, aging times, and temperatures is reported. The activation energy for the stress-induced strain aging was found to be 10,000 cal/mol. The results are interpreted as dislocation pipe line diffusion of carbon.

NUCLEAR PHYSICS AND NUCLEAR CHEMISTRY

General Research Co., Beverly Hills, Calif.
INVESTIGATION INTO THE NATURE OF SHORT RANGE NUCLEAR FORCES, by Kuno G. Foelsch. Technical note on Phase I on Contract AF 18(603)88. 15 Mar 57, 41p. AFOSR TN-57-145; AD 126 434.
Order from LC mi $3.30, ph $7.80 PB 134 412

An attempt is made to simplify the physical picture of a nucleus by assuming that electrons and positrons, the elementary particles, are the building stones of the nucleon (proton and neutron). An exponential function of the distance is introduced with a linear coupling factor which is computed from the electrostatic charge of the elementary particle and its mass. By this function the character of the Coulomb Law in the nuclear field is substantially changed, thereby providing the possibility to obtain electrostatic equilibrium between any number of electrons and positrons. This new idea is first applied to the dynamics of the mass point.

Inland Testing Labs., Chicago, Ill.
BIBLIOGRAPHY: FORMULATION OF AN ENVIRONMENTAL TESTING PHILOSOPHY FOR ANP WEAPON SYSTEMS, by P. M. Van Arsdell. Rept. 3 on Experimental Techniques Supporting the Design and Operation of the AF Nuclear Engineering Test Facility, Contract AF 33(616)3912. June 57, 215p. 2000 refs. WADC Technical note 57-229; AD-130 775.
Order from LC mi $9.60, ph $33.30 PB 135 128

This report is the result of a systematic review of over 10,000 documents and presents a comprehensive cataloged and cross-index bibliography of presently available information on Radiation Damage. Over 2000 references are compiled on all facets of Radiation Effects and Radiation Sources. It is believed that this information will provide an invaluable source for any future work contemplated in the field of Radiation Effects on Materials.

Nuclear Engineering and Power

Engineering Research Inst., U. of Michigan, Ann Arbor.
DEVELOPMENT OF APPARATUS AND METHODS FOR MEASUREMENT OF CREEP TO TEMPERATURES OF 3500°F, by M. J. Sinnot. Progress rept. no. 15, 15 Sept-15Oct 49. 8p. NEPA-1219-MIC-15; AD-122 313.
Order from LC mi$1.80, ph$1.80 PB 135 677

Engineering Research Inst., U. of Michigan, Ann Arbor.
DEVELOPMENT OF APPARATUS AND METHODS FOR MEASUREMENT OF CREEP AT TEMPERATURES TO 3500°F, by M. J. Sinnot. Progress rept. no. 16, 15 Oct-15 Nov 49. 8p. NEPA-1219-MIC-16; AD-122 312.
Order from LC mi$1.80, ph$1.80 PB 135 678

Naval Research Lab., Washington, D. C.
NAVAL RESEARCH LABORATORY RESEARCH REACTOR. PART IX: MEASUREMENT OF FAST-NEUTRON BEAM CURRENTS, by F. E. Jablonski and A. F. DiMeglio. 4 Nov 58, 10p. 11 refs. NRL rept. 5213.
Order from OTS $0.50 PB 151 058

In many beam-port physics experiments using reactors, low-energy (thermal) neutrons are required and high-energy (fast) neutrons constitute background. In the water-moderated NRL Research Reactor. the energy integrals of the fast and thermal neutrons are of the same order of magnitude. To overcome this situation and to increase the thermal-to fast-neutron ratio, a split core has been proposed. A split core is one in which the beam ports view only unfueled regions in the reactor core. An experimental comparison has been made of the fast-neutron beam currents emerging from a mock split core and a normal core. It has been experimentally shown that the fast-neutron background at 4. 5 Mev can be reduced by about a factor of 10 through the use of a split core. (See also PB 131 734)

Nepa Div., Fairchild Engine and Airplane Corp., Oak Ridge, Tenn.
OPERATION OF A FRACTIONAL-HORSEPOWER MOTOR IN A HIGH VACUUM SYSTEM, by W. E. Browning and J. G. Henry. 28 Feb 51, 2p. NEPA-1751. AD-149 902.
Order from LC mi$1. 80, ph$1. 80 PB 135 660

PHYSICS

Acoustics Lab., Mass. Inst. of Tech., Cambridge.
QUARTERLY REPORT, JULY-SEPTEMBER 1957. Final rept. on Contracts AF 19(604)2051, AF 19(604) 2061, AF 33(616)3307 and Nonr-1841(42). 39p. 32 refs. AFCRC TN-57-966; AD-133 794.
Order from LC mi$3. 00, ph$6. 30 PB 135 247

Contents:
A terminal analog of fricative consonant articulation
Measurements of the transient response of the vocal tract
Analog speech synthesizer
Speech bandwidth compression system
Auditory tests
A wide-range electrostatic loudspeaker
Excitation of damped resonators by wind
Sound field generated inside a cylinder by a simple harmonic ring source
The diffraction of a plane sound wave by a semi-infinite thin elastic plate
The effect of a reflecting plane on the power output of a simple sound source
Measurement of the noise produced by interacting jets
Dispersion relation for flexural waves
Internal friction of solids
Field measurements of sound propagation

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park
AXISYMMETRIC FREE-CONVECTION TEMPERATURE FIELD ALONG A VERTICAL THIN CYLINER, by Frances R. Hama and John V. Recesso. Rept. on Contract AF 18(600)1014. Jan 58, 57p. 17 refs. Technical note BN-116; AFOSR TN-58-25; AD-148 064.
Order from LC mi$3. 60, ph$9. 30 PB 133 354

The axisymmetric free-convection problem along a vertical thin cylinder is investigated theoretically as well as experimentally with a view to studying the effect of strong transverse curvature on boundary-layer problems. A theory is developed as an extension of the Glauert-Lighthill-Pohlhausen solution for any value of the x-parameter. Temperature profiles are measured at several sections along an electrically-heated brass cylinder of 10 foot height and 1/4 inch diameter. Experimental results of the local-heat-transfer coefficient agree well with the theory.

Princeton U., N. J.
TRANSITION PROBABILITIES FOR THE MORSE OSCILLATOR WITH A CUBIC DIPOLE MOMENT, by David Garvin. Technical note no. 2 on Contract AF 18(600)134. 17 Feb 58, 8p. AFOSR TN-58-146; AD-152 173.
Order from LC mi $1. 80, ph $1. 80 PB 135 074

A series of formulae are recorded for transition probability matrix elements for the non-rotating Morse oscillator suitable for use with linear, quadratic and cubic dipole moment expressions. These represent a re-formulation of the results obtained by Heaps and Herzberg for the case of the quadratic dipole moment expression, and an extension of the cubic integral. These formulae were derived using the factorization technique developed by Infeld and Hull and used by them to obtain the linear integral. A direct extension of the procedures explained by them yields the quadratic and cubic integrals. The expression for the quadratic integral yields the same specific formulae for particular transitions as those obtainable from the work of Heaps and Herzberg. The cubic integral has been checked, for several specific cases, against the results of Herman and Rubin. The principal advantage of the expressions is that the computational labor involved in the evaluation of transition moments for the higher 'overtone' bands is markedly reduced from that required when the other sets are used. In addition, certain approximations permit rapid computation with little loss in accuracy.

Yerkes Observatory, Williams Bay, Wis.
THEORETICAL TREATMENTS IN MAGNETO-HYDRODYNAMICS, by V. C. A. Ferraro, Guro Gjellestad and others. Final rept. 1 Apr 52-31 Dec 56 on Contract AF 19(604)299. Jan 57, 46p. AFCRC TR-57-242; AD-146 775.
Order from LC mi $3. 30, ph $7. 80 PB 133 826

The statement of work as outlined in the original proposal reads: "The development of new theoretical treatments in magneto-hydrodynamics for a study of the magnetism of rotating bodies with particular emphasis on the earth's magnetism and its variation. The treatment will be extended to include applications to the aurora, the ionosphere and other ionized media moving in an external magnetic field." This is the final report on the work done on the contract.

Optics

Diamond Ordnance Fuze Labs., Washington, D. C.
SOME SOLUTIONS OF LAPLACE'S EQUATION (WITH PARTICULAR REFERENCE TO ELECTRON MOTION IN A PLANE) by William E. Waters. May 58, 18p. TR-594.
Order from LC mi$2.40, ph$3.30 PB 135 144

Exact solutions of Laplace's equation in two dimensions, such as to produce a circular electron path, are derived. A power series representation of the potential at points close to the circular path is obtained. A power series is developed for the potential in the vicinity of a curved, but not-necessarily-circular electron path.

Institute of Mathematical Sciences, New York U., N. Y.
AN INTEGRAL REPRESENTATION OF THE ELECTROMAGNETIC FIELD IN THE IMAGE SPACE OF AN OPTICAL SYSTEM, By Emil Wolf. Rept. on Contract AF 19(604)1717. Mar 58, 21p. 14 refs. Research rept. no. EM-112; AFCRC TN-58-154; AD-152 385.
Order from LC mi$2.70, ph$4.80 PB 135 505

Preliminary to the study of the structure of an optical image from the standpoint of electromagnetic theory, an integral representation is obtained for the electromagnetic field in the image space of an optical system. This representation, which is not restricted to systems of low angular aperture, is in the form of an angular spectrum of plane waves, and is closely related to that introduced by Luneberg (1944) as a vector generalization of well-known formulas of Debye (1909) and Picht (1925). It is shown that the representation has a simple physical interpretation in terms of a modified Huygens-Fresnel principle which operates with secondary plane waves rather than with secondary spherical waves.

Institute of Optics, U. of Rochester, N. Y.
THE REFRACTIVE INDEX AND FARADAY EFFECT IN SOLID SOLUTIONS, by D. L. Dexter. Rept on Contract AF 18(600)688. Feb 58, 20p. 16 refs. AFOSR TN-58-286; AD-154 190
Order from LC mi$2.40, ph$3.30 PB 135 426

The change in the index of refraction and the magnitude of the Faraday effect are computed for nonmetallic crystals (or solutions) containing impurities or color centers. Previous experimental and theoretical studies are compared.

Technical Operations, Inc., Arlington, Mass.
EXPERIMENTAL MEASUREMENTS OF DIFFUSE TRANSMITTANCE IN REAL ATMOSPHERES, by Ralph G. Eldridge and John C. Johnson. Final rept. on Contract AF 19(604)988. 1 Dec 56, 124p. Rept. no. TOI 56-30; AFCRC TR-57-277; AD-177 199.
Order from LC mi$6.30, ph$19.80 PB 135 586

The effect of weather and geometry on radiant energy emitted from isotropic sources is summarized by curves of relative intensity as a function of range. Data are grouped according to 2 major atmospheric configurations: (1) apparent transmittance in relatively clear atmosphere near reflecting surfaces and (2) transmittance through turbid atmospheres. The transmissions through a complex media (partly clear air and partly clouds) are adjusted in range so that the transmittance is entirely within the cloud. When the data are adjusted through the elimination of the clear air path, the assumption was made that the attenuation of energy in a clear atmosphere follows the inverse square law. A negligible error is introduced by this assumption when a large difference is considered between the extinction coefficients representing atmospheric haze and clouds. These curves indicate the broad transmission properties of the atmosphere under a variety of meteorological conditions. A more detailed description of the atmospheric transmission properties under a greater variety of conditions and with greater instrument control is recommended.

Solid State Physics

Institute of Optics, U. of Rochester, N. Y.
ANISOTROPIC EFFECTS IN OPTICAL EXCITATION IN MOLECULAR CRYSTALS, by David Fox and Shaul Yatsiv (Hebrew U.) Rept. no. 19 on Contract AF 18(600)688. Sep 57, 42p. 18 refs. AFOSR TN-57-597; AD-136 583.
Order from LC mi $3.30, ph $7.80 PB 132 290

The expression for the energy of an exciton state contains certain dipole lattice sums. These sums are strongly dependent on the direction of the propagation vector of the exciton, even when the magnitude of this vector is very small. As a result, the energy of an optically-excited exciton may depend strongly on the direction of propagation of the absorbed radiation, if the excitation takes place coherently over a region whose linear dimensions are comparable with or much larger than a wavelength. The behavior of the lattice sums may also introduce a dependence of the exciton polarization and of the absorption coefficient on the direction of propagation. The magnitudes of these effects were calculated for the cases of the first and second transitions of napthalene and of anthracene. Experimental observations of the extent to which these effects occur could provide information on the dimensions of excitation of the exciton.

Washington U., Seattle
THE EXCITATION OF NUCLEAR SPIN TRANSITIONS IN CRYSTALS BY ULTRASONIC OSCILLATIONS, by Edwin A. Uehling. Rept on Contract AF 18(600)653. 1 Apr 58, 19p. AFOSR TR 58-51: AD-154 201.
Order from LC mi $2.40, ph $4.40 PB 135 416

A connection between orientations of nuclear spins in crystals and the lattice vibrations is established. Additional objectives realized include measurement of the vibrational energy which is required in order to disturb the spin orientation by a known amount and study of the sensitivity of this effect in several distinctly different types of crystals.

Wave Propagation

Air Force Cambridge Research Center, Bedford Mass.
ON THE PROPAGATION OF RANDOM ELECTROMAGNETIC WAVES IN FREE SPACE, by Mark J. Beran. Feb 58, 38p. AFCRC TR-58-112; AD-146 826.
Order from LC mi $3.00, ph $6.30 PB 135 232

This treatment of the propagation of random radiation through free space is based on the use of ensemble averages and is in the main scalar theory. The principal statistical parameter considered is the n-point correlation function. The equations governing its propagation are derived and solutions obtained for the two-point correlation function in a number of specific geometries. An application of the theory to the field of scatter communications is given.

Naval ResearchLab., Washington, D. C.
CHARACTERISTICS OF RADAR SEA CLUTTER: OBSERVATIONS AT 220 MC, by W. S. Ament, J. A. Burkett and others. 19 Nov 58 [17]p. 4 refs. NRL rept. 5218.
Order from OTS $0.50 PB 151 132

Measurements of sea-clutter echo power and fluctuation characteristics have been made with a 220-MC horizontally polarized radar mounted in a blimp. For well-developed sea conditions, with surface winds varying from 0 to 12 knots, there was little variation in σ_0, the radar area per unit horizontal area of sea surface, as a function of azimuth. As a function of grazing angle θ, σ_0 varied as θ^4 over 1 to 14 deg, the range of the observations. Clutter fluctuation rates were generally higher when the radar looked crosswind than when it looked up or downwind. Crosswind echoes often contained well-defined periodic fluctuations at rates corresponding to twice the period of a classical ocean wave of half the radar's wavelength. The upwind echoes often fluctuated at high rates corresponding to the beat frequency between an echo from a stationary target and an echo from a wave crest moving at the dominant oceanographic crest speed.

Raytheon Mfg. Co., Waltham, Mass.
INOSPHERE PROPAGATION STUDIES, by Leonard C. Edwards. Scientific rept. no. 2-1, 15 June-15 Sep 57, on Contract AF 19(604)2246; Continuation of Contract AF 19(604)1413. 15 Oct 57, 23 p. AFCRC TN-57-770; AD-133 715.
Order from LC mi $2.70, ph $4.80 PB 135 603

Continuous measurements are being made at South Dartmouth, Mass. of CW signals transmitted from Greencastle, Indiana. Data are being collected which describe possible seasonal variations in the level of scatter signals. The average signal levels are given for the ionosphere scatter mode for June, July, and August 1957. The choice of proper antennas is briefly discussed for the design of ionosphere scatter communication circuits. Special attention will be given to the changes in signal level which occur when the operating frequency is near the classical MUF for the path.

Smyth Research Associates, San Diego, Calif.
EVALUATION OF TROPOSPHERIC PROPAGATION, by L. G. Trolese, L. J. Anderson and others. Final rept. 1 May 56-11 Mar 57, on Contract DA 36-039-sc-67856. 35p. 27 refs. SRA-31; AD-133 564.
Order from LC mi$3.90, ph$10.80 PB 135 377

This work consisted of two phases: (1) consultation with engineers concerning recommendations for radio propagation tests, and (2) analysis of previous data taken by the Navy Electronics Laboratory for the purpose of extracting information useful to their communications test program. The work accomplished in these two phases is reviewed, and the major points are discussed. Recommendations are made concerning further work as well as the ways in which the past and future work can be applied to operational communications problems.

Stanford U., Calif.
NONLINEAR PROBLEMS OF ONE-DIMENSIONAL WAVE PROPAGATION IN GASES (TREATED BY THE RITZ METHOD) by Ian M. Fyfe and K. Klotter. Rept. on Theoretical Study of Acoustic Energy Generation, Propagation and Reception, Contract AF 33(616)3490. Aug 58, [74]p. 14 refs. WADC Technical rept. 58-293; AD-155 880.
Order from OTS $2.00 PB 151 281

The Ritz Method has been used extensively in solving statical and vibration problems. In this report the feasibility is investigated of applying the Ritz Method to wave propagation problems involving one space coordinate in addition to the time. In order that the Ritz Method can be applied it is necessary to obtain a functional in an integral which fully describes the problem, and if possible contains only one dependent variable. The bulk of this report is concerned with the two problems of (a) obtaining that functional and (b) of selecting the appropriate assumed form of the solution. The problems of a plane wave propagating in a tube and of spherical symmetrical waves are considered as examples.

RESEARCH METHODS, TECHNIQUES AND EQUIPMENT

Air Force Cambridge Research Center, Bedford, Mass.
SOME CYCLIC ERROR-CORRECTING CODES WITH SIMPLE DECODING ALGORITHMS, by Eugene Prange. Apr 58, 18p. AFCRC TN-58-156; AD-152 386.
Order from LC mi$2.40, ph$3.30 PB 135 504

The properties of two cyclic error-correcting codes of length 21 in the two symbols 0 and 1 are studied. The codes are of orders 2^{11} and 2^{12} respectively. Coding for each code is by means of a linear recursion. Both codes have simple decoding algorithms. The second is quasi-perfect.

SOCIAL SCIENCES

Documentation, Inc., Washington, D.C.
DESIGN CONSIDERATIONS OF INFORMATION STORAGE AND RETRIEVAL MACHINES, by Frederick Jonker. Rept. on Contract AF49(638)91. Apr 58, 27p. AFOSR TN 58-367; AD-154 273.
Order from LC mi$2.70, ph$4.80 PB 134 759

Basic and applied parameters for the design of information storage and retrieval devices are discussed. A distinction is made between primary design considerations of a more abstract nature, and less abstract design considerations are used as a framework for classifying the various types of information storage and retrieval systems. This classification is a practical frame of reference to allow us to see similarities and differences and to apply systematic thinking to the problems of information storage and retrieval machines. It may help create some order in the ever-growing tangle of competing systems.

MISCELLANEOUS

Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS. Jan 59.
Order from OTS $1.25. Also available on annual subscription rate of $10 a year in the U.S.A., foreign rate $13 a year. PB 151 334

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Articles:

Rocket astronomy at the total eclipse of October 12, 1958, by H. Friedman.

Data reliability and the aircraft-collision problem, by P. J. LaRocheele and R. E. Brescia.

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Astronomy and Astrophysics: Solar spectral intensity measurements during the eclipse of June 30, 1954.

Chemistry: Adsorption of soluble fluorocarbon derivatives at the organic-liquid/air interface. Degradation of polymers by near-ultraviolet radiation.

Mechanics: Effect of low-temperature aging cycles on elastically shocked specimens. Toughness of polyester-base aircraft glazing materials.

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Nuclear and Atomic Physics: Packaged, battery-powered, scintillation detector for photonuclear reactions.

Radio: Effects of ambient illumination, c-r tube bias, and noise upon target detectability with a B-display. Microwave characteristics of magnesium manganese ferrite aluminates. New twenty-element spiral antennas has good scanning properties.

Solid-State Physics: Vibration spectra and dispersion relations of face-centered cubic lattices.

Supporting Techniques: A Resistivity Probe.

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Index of Unclassified Reports (January - December 1958)

ATOMIC ENERGY COMMISSION REPORTS

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Administrative

The reliability and relevance of a modified critical incidents performance evaluation system, by William J. Wilcox, Jr. Union Carbide Nuclear Company. Oak Ridge Gaseous Diffusion Plant, Oak Ridge, Tenn. Oct 1958. Contract W-7405-eng-26. 55p. Order from OTS. $1.75. K-1392

Biology and Medicine

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